

*Serials  
extra*

*For your File*

Vol. XII

No. 4

# DISSERTATION

## ABSTRACTS

(formerly MICROFILM ABSTRACTS)

*A GUIDE TO DISSERTATIONS AND  
MONOGRAPHS AVAILABLE IN MICROFORM*

*2*

\$6.00 PER YEAR  
\$1.50 SINGLE COPIES









Vol. XII

No. 4

# DISSERTATION

## ABSTRACTS

(formerly MICROFILM ABSTRACTS)

*A GUIDE TO DISSERTATIONS AND  
MONOGRAPHS AVAILABLE IN MICROFORM*

UNIVERSITY MICROFILMS  
ANN ARBOR, MICHIGAN: 1952



LITHOPRINTED IN THE UNITED STATES OF AMERICA BY  
CUSHING-MALLOY, INC., ANN ARBOR, MICHIGAN, 1952



## INTRODUCTION

With a view toward a more accurate and descriptive title, the name MICROFILM ABSTRACTS has been changed to DISSERTATION ABSTRACTS. The format has been changed from 5 1/2 x 8 1/2 inches to 8 1/2 x 11 inches, since with this larger size less shelf space will be required in libraries. There will be six issues per year, one containing cumulative author and subject indexes for the year. The free distribution to selected libraries has been discontinued in favor of a straight subscription basis.

It is hoped that the use of microfilm publication will increase, since greater participation makes DISSERTATION ABSTRACTS an increasingly valuable bibliographical tool.

The normal procedure for publication by microfilm is as follows:

- a. The author submits a carefully typed ribbon copy of the manuscript ready for publication without corrections.
- b. He also submits an abstract of 600 words or less, accurately describing the contents of the manuscript, as a guide, but not as a substitute for the complete dissertation.
- c. Both the abstract and the manuscript must be approved by the candidate's committee and the Graduate Dean as ready for publication.
- d. The manuscript is microfilmed and the negative carefully inspected and put in the vault of University Microfilms for storage, where it is kept available for purposes of duplication upon request.
- e. The abstract is printed in DISSERTATION ABSTRACTS, which is distributed, both in this country and abroad, to a large number of subscribing libraries as well as to leading abstracting services.
- f. The charge for this service is \$20.00 irrespective of the size of the manuscript.
- g. Anyone, after consulting the abstract and concluding the complete manuscript would be of value, can obtain a microfilm copy from University Microfilms at 1 1/4 cents per page, or as a paper enlargement at 10 cents per page.

There are varying degrees of partial participation in this plan available at the option of the institution. Titles only will be listed in DISSERTATION ABSTRACTS for a charge of \$2.00 each. When a university wishes to prepare its own negatives according to certain specified standards, and have that negative stored at University Microfilms where it will be available for duplication, the charge is \$12.00, which includes publication and distribution of the abstract and storage of the negative. Conceivably certain institutions will wish not only to prepare their own negatives, but to service copies as well in either microfilm, microcard or microprint. In this instance the abstract will be printed in DISSERTATION ABSTRACTS, and any requests for copies will be forwarded to the servicing institution. Interested institutions should write University Microfilms for further details of this service.

This method separates the two necessary functions of publishing: notification, or the process of informing prospective users of the existence and contents of a manuscript and distribution, or the furnishing of a copy upon demand. Each of these functions pays its own way, since if no one wishes a copy, the investment is small. However, if there is a demand, copies can be produced at current book rates.

It is anticipated that by enlarging the scope of DISSERTATION ABSTRACTS this publication will become of increasing value to librarians and scholars as a research tool. If this ideal is to be realized, close cooperation between sponsoring institutions, doctoral candidates, and University Microfilms is of the utmost importance. Now that the service is available to all Graduate schools regardless of the way its candidates publish their dissertations, it is hoped that the goal of a complete bibliography of doctoral dissertations may be realized within the next few years. Institutions are urged to write for further details.



Upon recommendation of the Committee on Microfilming of Doctoral Dissertations of the Association of Research Libraries, the subject headings have been adjusted to agree with those used by Trotier in DOCTORAL DISSERTATIONS.\* For this volume, then, there is a mixed system of subject headings. It is anticipated that in succeeding volumes the classification headings will be better systematized and clarified.

\*DOCTORAL DISSERTATIONS ACCEPTED BY AMERICAN UNIVERSITIES. 1949-50 (Number 17).  
ed. A. H. Trotier and M. Harman. New York, 1950.

## CONTENTS

### BIOLOGICAL SCIENCES

#### AGRICULTURAL AND BIOLOGICAL CHEMISTRY

A Study of Some Physical and Chemical Changes Associated with the Storage of Poultry Meat -- Milo Harland Swanson . . . . .	Page 345
---	-------------

#### AGRICULTURE

Studies on the Effect of Some Environmental Conditions and Chemicals on the Development of <u>Puccinia graminis avenae</u> Erikss. and Henn. -- Ismail Ali Ibrahim . . . . .	345
Variability in Resistance of Certain Wheat Varieties to <u>Puccinia graminis tritici</u> Race 15 -- Tapa Nath Shukla . . . . .	346

#### AGRONOMY

Some Plant Breeding Studies with Tall Fescue ( <u>Festuca Arundinacea</u> Schreb.)-- John Ritchie Cowan . . . . .	347
A Study of the Inter-Relationships of Seed Yield, Oil Content and Other Agronomic Characters with Sunflower Inbred Lines and Their Top Crosses -- Wilbert Ambrick Russell . . .	347
An Evaluation of the Production and Economic Return from Pastures on a Midwestern Claypan Soil -- Darnell Moses Whitt . . . . .	348

#### ANATOMY

The Prenatal Development of the Human Femur -- William Joseph Lawrence Felts . . . . .	349
Patterns of Cardio-Thoracic Venous Drainage in the Rat -- Myron Herbert Halpern . . . . .	350
The Human Embryonic Heart at the Beginning of the Third Month -- Richard Harry Licata . . . .	350
An Anatomical and Experimental Study of the Cerebellar Nuclei and Their Efferent Pathways in the Monkey -- Robert Wheeler Rand . . . . .	351
Studies of the Spinal Cord - Three Ascending Proprioceptive Systems -- Robert Eugene Yoss . . . . .	352

#### ANIMAL HUSBANDRY

Nutritional Requirements of Swine -- Gerald Clifton Anderson . . . . .	352
Reproductive Development and Performance of Boars from Certain Inbred Strains and Their Crosses -- Edward Richard Hauser . . . . .	353
Deterioration in Frozen Pork as Related to Fat Composition, Storage Temperature, Length of Storage Period and Packaging Treatment -- Arno Zane Palmer . . . . .	354
A Study of Selection for Factors of Performance in Inbred Lines of Poland China Swine -- William Ewert Rempel . . . . .	354

#### BACTERIOLOGY AND MICROBIOLOGY

Characterization of Leucocytolysis in Experimental Sensitization to a Group B Streptococcus -- Robert English Chamberlain . . . . .	355
The Phenomena of Plugging in Paper Machine Wet Felts -- David Weston French . . . . .	355
Studies in Pigmentation in <u>Micrococcus Pyogenes</u> Var. <u>Aureus</u> -- David John Kahler . . . . .	356
An Investigation of a Specific Sedimentation Effect of Certain Synthetic Compounds on Pneumococci -- Frederick Charles Kull . . . . .	357
The Nutrition and Factors Affecting the Growth of Bacteria in Soluble Oils -- Hilliard Pivnick . . . . .	357



BIOLOGICAL CHEMISTRY	Page
The Chemical Fractionation of Mammalian Spermatozoa into Lipoprotein, Basic Protein and Desoxypentose Nucleic Acid -- Richard Duncan Dallam . . . . .	358
Some Problems of Biological Conjugation of Benzoic Acid -- Adrian Hainline, Jr. . . . .	358
The Isolation of Globulins from Cell Nuclei -- William Richard Kirkham . . . . .	359
Studies of the Enzymatic Deamination of Purines and Pyrimidines -- Jacob Kream . . . . .	359
The Biochemistry of Dormancy in the Myxomycete <u>Physarum Polycephalum</u> -- Andrew Jackson Sullivan, Jr. . . . .	359
Influence of Some Nutritional Factors on the Ash Content, Breaking Stress, and Elasticity of Rat Bones -- John Patrick Towey . . . . .	360
The Amino Acid Composition and Nitrogen Metabolism of <u>Tetrahymena Geleii</u> -- Chung Wu . . .	361
BOTANY	
Absorption of Radiocalcium by Potato Tuber Slices -- William Gordon Long . . . . .	362
A Study of the Tetrazolium Reaction in Plant Tissues -- Lorin W. Roberts . . . . .	363
Enzyme Studies on Dormant and Active Potato Tubers -- Glen William Todd . . . . .	363
DAIRY HUSBANDRY	
The Fat-Globule Membrane of Homogenized Milk and Some Related Factors -- Jay Robert Brunner . . . . .	364
A Study of Some Causative Mechanisms in Streptococcus Agalactiae Infections of the Bovine Mammary Gland -- Charles Preston Merilan . . . . .	365
A Survey of the Utilization of C <sup>14</sup> Carboxyl Labeled Acetate by the Perfused Bovine Mammary Gland -- Lewellyn Stanley Mix . . . . .	365
Uniformity Trials and Effects of Varying Planes of Nutrition on Performance of Monozygotic Bulls -- Howard Halfdan Olson . . . . .	366
The Role of Plasma Cells in the Production of Globulins Within the Mammary Gland and Time Studies on Antibody Response from Experimentally Induced Inflammation of the Udder -- Robert Milo Porter . . . . .	366
A Histological and Histochemical Study of the Bovine Oviducts, Uterus and Placenta -- Howard James Weeth . . . . .	367
FORESTRY AND CONSERVATION	
Cooperative and Federal Sustained-Yield Forest Units -- A Problem in Resource Management -- Thomas Cooper Adams . . . . .	368
Factors Influencing the Incidence of Hypoxylon Canker of Aspen -- Ralph Leo Anderson . . . . .	368
The Silvics and Silvicultural Treatment of Black Cherry in Northwestern Pennsylvania -- Bertram Husch . . . . .	369
Lead Poisoning in Migratory Waterfowl, with Special Reference to the Mallard <u>Anas platyrhynchos</u> L. -- James Schuyler Jordan . . . . .	370
The Sage Grouse in the Upper Green River Basin of Wyoming -- Robert Lansing Patterson . . .	370
GENETICS	
Inheritance of Reaction to Leaf Rust, <u>Puccinia Rubigovera Tritici</u> (Eriks.) Carleton, and of Certain Other Characters in a Wheat Cross -- Lorenzo Martinez M. . . . .	371
HORTICULTURE	
A Study of the Inheritance of Several Characters in the Cucumber, <u>Cucumis sativus</u> , L. -- Victor Bernarr Youngner . . . . .	372

MEDICINE AND SURGERY	Page
A Study of the Pathogenesis of Coronary Sclerosis: An Analysis of its Development with Relation to Age, Sex, and Other Factors -- Paul Hallam Lober .....	373
Iodine in the Blood and Urine of Man -- Joseph Edward Rall .....	373
PHYSIOLOGY	
Stress Induced by Muscular Exertion as Indicated by Changes in Leucocyte Concentration and Urinary Ketosteroids: A Study of Certain Physiological Changes Induced by Exercise -- Nathan Lavenda .....	374
PLANT PATHOLOGY	
Studies on Viruses of Cereal Grains -- Robert Emmet Atkinson .....	375
PSYCHOLOGY	
The Relation between Three-Dimensional Visualization and Mental-Spatial-Manipulation -- Mohamed Abdel-Salam Ahmed .....	375
Functional Interrelationships of Word Association, Perception, Learning, and Memory -- Beatrice Irene Bryan .....	376
Abstract Sets Measured by the Picture Similarities Test -- Seymour Irving Canter .....	377
A Study of Role Conflict Among Foremen in a Heavy Industry -- Werrett Wallace Charters, Jr. ....	377
Some Personality and Social Correlates of Social Insight and Conformity -- Harold Feldman .....	378
Stimulus Satiation as an Explanation of Spontaneous Alternation in Rats -- Murray Abraham Glanzer .....	379
Intellectual Rigidity and Social Attitudes -- Leonard David Goodstein .....	379
A Study of Measured Personality Variables and their Behavioral Correlates as Seen in Oil Paintings -- John Lewis Holland .....	380
The Minnesota Multiphasic Personality Inventory Applied to the Problem of Prognosis in Schizophrenia -- William Lorne Jenkins .....	381
A Comparison of Two Methods of Collecting Data for Social Research: The Fixed-Alternative Questionnaire and the Open-Ended Interview -- Robert Louis Kahn .....	382
The Relation of Food Deprivation to Certain Measures of Perception -- Florenz Dudley Klopfer .....	382
A Study of Changes in Body Image During Psychotherapy -- Jerome William Kosseff .....	383
Auditory Perception of Emotional Words: A Comparison of Two Groups of Patients and a Normal Group -- Shabse Howard Kurland .....	384
Supervisory Training and Employee Attitudes -- Theodore Rudolph Lindbom .....	385
Certain Content of Prejudices Against Negroes Among White Children at Different Ages -- Ibrahim Abdullah Muhyi .....	385
The Perception of Meaning in Schizophrenia -- Charles Edmond Orbach .....	386
Social Power and Interpersonal Adjustment -- Sidney Rosen .....	387
Forming Impressions of Persons from Verbal Report: A Study of Schizophrenic and Normal Groups -- Gerald Donald Rosenbaum .....	387
The Relationship of Certain Personality Factors to Prognosis in Psychotherapy -- Selig Rosenberg .....	388
An Analysis of the Sign-Gestalt Interpretation of Behavior at a Choice-Point: Studies on the Role of Extra-Maze Cues and the Effects of Pre-Extinction in Place and Response Learning -- Donald Peter Scharlock .....	389
An Experimental Investigation of the Consistency of Stress Tolerance and Related Rorschach Factors -- Murray S. Stopol .....	390

<b>PSYCHOLOGY -- cont'd.</b>	<b>Page</b>
The Relationship of Psychotherapeutic Skill and Experience to Knowledge of Other People -- Norman Dale Sundberg .....	390
Variations in Spectral Sensitivity within the Human Fovea -- John Hall Taylor .....	391
A Comparative Study of the Vocational Interests, Aspirations, and Achievements of Selected Groups of Veteran Psychiatric Patients -- Albert E. Uecker .....	392
Studies in Radiotelegraphy -- Charles David Windle .....	392
Consistency of Immediate and Delayed Report of Financial Data -- Stephen Bassett Withey ...	393
<b>PSYCHOLOGY, PATHOLOGICAL</b>	
Syndromes Found in Psychiatric Population Selected for Certain MMPI Code Endings -- Joel Malcolm Cantor .....	394
Visio-Verbal Test for Schizophrenia -- James Drasgow .....	394
Stimulus Ambiguity and Personality Maladjustment as Related to Perceptual Adequacy -- Mortimer Powell Lawton .....	395
Some Psychometric Evaluations of Epilepsy -- Herbert Bernard Malos .....	396
Differential Effects of Focal Brain Damage on the Minnesota Multiphasic Personality Inventory -- Harold L. Williams .....	397
<b>ZOOLOGY</b>	
Morphology, Bionomics and Host-Parasite Relations of Planorbidae (Mollusca: Pulmonata) -- Emile Tadros Abdel-Malek .....	397
<u>Atractolytocestus Huronensis</u> N. Gen., N. SP., <u>Caryocestus</u> N. Gen. (Cestoda: Lytocestidae) with Notes on the Biology of the Former and a Review of the Lytocestidae -- James Douglas Anthony .....	398
The Crane-Fly Genus <u>Dolichopeza</u> in North America -- George William Byers .....	399
The Digestive Enzymes of <u>Ascaris Lumbricoides</u> , Var. Suis: Their Properties and Distribution in the Alimentary Canal -- Mary Frances Pitynski Carpenter .....	399
Genera of the Hydracarina in Michigan, with a Revision of the Michigan Arrenuridae -- David Russell Cook .....	400
A Taxonomic Study of the American Representatives of the Genus <u>Elaphe</u> Fitzinger, with Particular Attention to the Forms Occurring in Mexico and Central America -- Herndon Glenn Dowling .....	400
A Comparative Study of the Osteology and Myology of the Cranial and Cervical Regions of <u>Blarina Brevicauda Kirtlandi</u> and <u>Scalopus Aquaticus Machrinus</u> -- George Richard Lawrence Gaughran .....	401
The Birds on a Southern Michigan Farm -- John Lothar George .....	401
The Centipeds and Millipeds of Michigan -- Bert Marvin Johnson .....	402
The Snake Subfamily <u>Dipsadinae</u> in South and Central America -- James Arthur Peters .....	403
An Analysis of Some Physical Factors Affecting the Local Distribution of the Shorttail Shrew ( <u>Blarina Brevicauda Kirtlandi</u> ) in Northern Lower Michigan -- William Obadiah Pruitt, Jr. ....	404
The Skin Glands of Voles and Lemmings (Microtinae) -- Wilbur Brooks Quay .....	404
The Land Mammals of Southern Florida and the Upper Florida Keys -- Albert Schwartz .....	405
The Relation of Phytoplankton Periodicity to the Nature of the Physico-Chemical Environment in Certain Michigan Lakes -- Allan Tucker .....	405
The Influence of Different Numbers of Insects on Mortality Produced by Insecticides, as Shown with <u>Tribolium</u> SPP., and <u>Aedes Aegypti</u> L. -- Bansi Lal Wattal .....	406



## EARTH SCIENCES

## GEOGRAPHY

Page

- The Introduction of Flue-Cured Tobacco as a Commercial Crop in Norfolk County,  
Ontario -- Robert Burnett Hall, Jr. . . . . 407
- The Settlement of the Black Swamp of Northwestern Ohio -- Martin Richard Kaatz . . . . . 407
- Present and Future Settlement in the Hearst-Nipigon Region -- James Frederick  
Woodruff . . . . . 408

## GEOLOGY

- Paleocene and Early Eocene Stratigraphy and Vertebrate Paleontology of the Hoback  
Basin, Central Western Wyoming -- John Adam Dorr, Jr. . . . . 409
- Stratigraphy and Palaeontology of the Banff and Associated Carboniferous Formations  
of Western Canada -- Peter Harker . . . . . 409
- The Devonian Stratigraphy and Correlation of the Alberta Rocky Mountains with  
Descriptions of the Brachiopod Family Rhynchonellidae -- Digby Johns McLaren . . . . . 410
- Geochemical Prospecting Applied to the Illinois-Kentucky Fluorspar Area --  
Matthew Peter Nackowski . . . . . 410
- The Paleontology of the Chester Series of Southwestern Missouri -- Leo Milford Wright . . . . . 411

## MINERALOGY

- Structural Crystallographic Relation Between Sodium Sulfate and Potassium Sulfate  
and Some Other Synthetic Sulfate Minerals -- Mohamed Ezzeldin Hilmy . . . . . 412
- Mineralogy of the Moscovite-Lepidolite Series -- Alfred Abraham Levinson . . . . . 412

## HUMANITIES

## ART AND ARCHEOLOGY

- The Archeological Sequence on Marajó Island, Brazil, with Special Reference to the  
Marajoara Culture -- Betty Jane Meggers . . . . . 413

## DRAMA

- Thomas Holcroft and Elizabeth Inchbald: Studies in the Eighteenth-Century Drama  
of Ideas -- Bruce Robertson Park . . . . . 413

## JOURNALISM

- A Study of the Missouri Farmers Association, with Special Reference to the Public  
Relations Aspects -- Raymond William Derr . . . . . 414
- The Organization and Administration of Television Programming for School Systems  
and Institutions of Higher Learning -- Edward Charles Lambert . . . . . 415
- Bovard of the Post-Dispatch -- James Walter Markham . . . . . 416

## LANGUAGE

- A History of the Partitive Indefinite Construction in the Spanish Language --  
Lester Beberfall . . . . . 416

## LINGUISTICS

- The American English Pronunciation of Russian Immigrants -- Marshall Daniel Berger . . . . . 417
- A Phonemic Description of the Aran Dialect of Modern Irish, with a Detailed  
Consideration of Problems of Palatalization -- John Paul Hughes . . . . . 417
- Research Problems in Bilingualism, with Special Reference to Switzerland --  
Uriel Weinreich . . . . . 418

LITERATURE	Page
Walter Bagehot: A Study in Religious Compromise -- Robert James Ames . . . . .	419
The <i>Kōnzyaku Monogataryū</i> : An Historical and Critical Introduction, with Annotated Translations of Seventy-Eight Tales -- Robert Hopkins Brower . . . . .	420
The Critical Theory of David Hume -- Ralph Cohen . . . . .	420
John Masefield: Interpreter of England and Englishmen -- Fraser Bragg Drew . . . . .	421
Po Chü-i as a Censor: His Memorials Presented to Hsien-Tsung During the Years 808 - 810 -- Eugene Feifel . . . . .	422
The Growth of the Meiji Novel -- Horace Ziegler Feldman . . . . .	422
The Life of Apuleius and His Connection with Magic -- Cecil Paige Golann . . . . .	423
The American Scene in Friedrich Gerstäcker's Works of Fiction -- Bjarne Emil Landa . . . . .	424
Charles Churchill as a Political Writer -- Dwight Augustus Lee . . . . .	425
Cato the Elder: An Interpretation -- Elsie Lewis Leeman . . . . .	425
Stasis and Dynamis: Two Modes of the Literary Imagination -- Allen Mandelbaum . . . . .	426
Formey and the Enlightenment -- Eva Dorothea Marcu . . . . .	426
Religion and William Butler Yeats -- Virginia Moore . . . . .	427
The Background of Spenser's <i>Prothalamion</i> -- Dan S. Norton . . . . .	428
Vol. I. Richard Johnson and <i>The Seven Champions of Christendom</i> (1596 and 1597): Materials for an Edition of His Works. Vol. 2. <i>The Seven Champions of Christendom</i> Part I by Richard Johnson Transcribed from the Edition of 1626? -- David Allan Robertson, Jr. . . . .	428
<i>The House that Jack Built</i> : A Study of Jack London: The Man, His Times, and His Works -- Abraham Alan Rothberg . . . . .	428
Gaspara Stampa -- Joseph Henry Satin . . . . .	428
William Butler Yeats: His Poetry and His Vision, 1914-1939 -- Morton Irving Seiden . . . . .	429
The Young England Movement -- Paul Smith . . . . .	430
William Blake & D. H. Lawrence: A Comparative Study in the Similarity of Their Thought -- Constantine Nicholas Stavrou . . . . .	430
An Introduction to Sainte-Beuve's Critical Vocabulary -- Carl Albert Viggiani . . . . .	431
Charles Dibdin and the Table Entertainment -- Edward Burdick Wisely . . . . .	431
MUSIC	
Anton Reicha's Quintets for Flute, Oboe, Clarinet, Horn and Bassoon -- Millard Myron Laing . . . . .	432
The Masses of Robert Fayrfax -- Edwin Brady Warren . . . . .	433
SPEECH	
An Experimental Study of Certain Relationships Between Intelligibility Scores and Clinical Data of Persons with Defective Articulation -- Victor Paul Garwood . . . . .	433
The Comprehension of Poetry from Recordings -- Bernard Jon Goldstein . . . . .	434
Variability of the Absolute Auditory Threshold: A Psychophysical Study -- George Herman . . . . .	435
Rhetorical Proof in Speeches of Women of the Reform Platform: 1828-1861 -- Lillian Mary Frances O'Connor . . . . .	435
A Critical Study of Booker T. Washington as a Speech-Maker with an Analysis of Seven Selected Speeches -- Willis Norman Pitts, Jr. . . . .	436
Broadcasting by the Newspaper-Owned Stations in Detroit, 1920-1927 -- Maryland Waller Wilson . . . . .	437



## PHILOSOPHY

Page

A Pragmatic Study of Language and Valuation -- Broadus Nathaniel Butler . . . . .	437
Dialectical Method -- Choon Sup Kim . . . . .	438
Deontology and the Moral Life: The Ethical Writings of H. A. Prichard, W. D. Ross, E. F. Carritt, and C. D. Broad -- Melvin Lubin . . . . .	439
Ralph Cudworth's Philosophical System -- Marilyn Meyer . . . . .	440

## PHYSICAL SCIENCES

## ASTRONOMY

The Excitation of the Network Nebulae in Cygnus -- Joseph Wyan Chamberlain . . . . .	441
Hydrogen Absorption Lines in the Spectra of B-Type Stars -- Jean Knox McDonald . . . . .	441

## CERAMICS

Determination of Progressive Corrosion of Clay Flux Blocks -- Ved Prakash Maheshwary . . .	442
--	-----

## CHEMISTRY

Reduction by Gallium, Aluminum and Mercury in Aqueous Solution -- Charles Robert Allenbach . . . . .	442
Mechanism of Rubber Reinforcement III Viscosity of Carbon Black Suspensions in GR-S Solutions -- Leonard Edward Amborski . . . . .	443
The Effect of Atmospheric Gases on the Interfacial Tensions Between Mercury and Several Liquids -- Richard James Bard . . . . .	444
A Comparison of Three Schedule Patterns in the Teaching of General Chemistry -- David James Blick . . . . .	444
The Use of a Rotating Sector in the Electron Diffraction Determination of the Molecular Structures of Three Methyl Silanes -- Arthur Chalmer Bond . . . . .	445
Adsorption of Vapors by Silica Gels of Different Structures: Free Surface Energy Changes Which Occur During Adsorption by Porous Adsorbents -- John Edwin Bower . . . . .	446
Selected Reactions of the Isomeric Chloroethyltrialkoxysilanes -- Frederick C. Boye . . . . .	446
Studies on the Degradation of Neoergosterol and Related Substances -- Michael Patrick Cava . . . . .	447
Substituted Acetylhydrazones of 5-Nitrofurfural II -- Murray Samuel Cohen . . . . .	447
Preferential Capillary Adsorption of Water from Solutions of Alcohols by Silica Gel -- Daniel Joseph Donahue . . . . .	448
Studies on the Degradation of the A Ring of Equilenin and Related Compounds -- Thelma Eskin Habgood . . . . .	449
The Synthesis of Nitrogen Mustard Derivatives of Some Steroids and Related Compounds -- George Gustave Hazen . . . . .	449
Kinetics of Elimination Reactions of Dihaloethylenes and the Mechanism of Trans Elimination -- Sidney Israel Miller . . . . .	450
The Preparation and Properties of Certain Alkyl and Alkoxy Derivatives of Vinyltrichlorosilane -- Roger M. Nagel . . . . .	451
Approaches to the Synthesis of Tetrahydrophenanthrene Analogs of the Cortical Steroids -- David Anson Tyner . . . . .	451
Microtitration of Zinc and a Study of Postprecipitation of Zinc in Semi Micro Qualitative Analysis -- Charles H. Wright . . . . .	452
The Separation of Cerium by Precipitation as Iodate from Homogeneous Solution -- Sylvia Shu Lien Tsai Yu . . . . .	453

CHEMISTRY, PHARMACEUTICAL	Page
The Preparation of Local Anesthetics and Antispasmodics from Basic Alcohols Which Contain 5-, 6-, 7- and 8-Membered Nitrogenous Rings -- Chi-Jung Lu . . . . .	454
Antihistaminics -- Gerald Robert Toy. . . . .	454
ENGINEERING, AERONAUTICAL	
On Compressible Laminar Flow in Ducts -- James Eugene Broadwell . . . . .	455
A Structural Theory Incorporating the Effect of Time-Dependent Elasticity -- Maurice Andre Brull . . . . .	455
A Shock Tube Investigation of Detonative Combustion -- Richard Boyd Morrison . . . . .	456
Some Effects of Surface Curvature on Laminar Boundary-Layer Flow -- James Sidney Murphy . . . . .	456
Some Special Problems in the Stability of Laminar Flows -- John Randolph Sellars . . . . .	457
ENGINEERING, CHEMICAL	
Rates of Alcoholysis and Diffusion in Ion-Exchange Resins -- George Edward Barker . . . . .	457
The Concentration of Oxygen Eighteen by Chemical Exchange -- Worthy Truman Boyd . . . . .	458
Electrochemistry of Systems Containing Aluminum Phosphate Dissolved in Fused Borate and Phosphate Mixtures -- Tsei-Yu Chao . . . . .	459
Surface Variables in Boiling -- Claude Corty . . . . .	460
A Study of the Formation of Gas Bubbles from Horizontal Circular Submerged Orifices -- Leon Davidson . . . . .	460
Two-Phase and Three-Phase Equilibria in the System: Carbon Dioxide-Methane -- Harold George Donnelly . . . . .	461
The Synthesis of Methane by the Hydrogenation of Carbon Monoxide in a Tubular Reactor -- Murray Mack Gilkeson, Jr. . . . .	461
The Effect of Ultrasonic Irradiation on the Specific Reaction Rate Constant in the Acid Hydrolysis of Ethyl Acetate -- Walter Clarke Gray . . . . .	462
The Effect of Some Ionic Crystals in Nucleating Quiet Supersaturated Potassium Chloride Solutions -- George William Preckshot . . . . .	463
An Investigation of the Reaction Between Carbon Monoxide and Hydrogen on a Nickel Catalyst at Pressures Above One Atmosphere -- John Ardell Pursley . . . . .	463
Mass Transfer in Liquid-Liquid Extraction -- Stanley Seltzer . . . . .	464
Mass Transfer Studies in Countercurrent, Liquid-Liquid Extraction Systems -- Adam Edward Skrzec . . . . .	464
ENGINEERING, CIVIL	
The Instability of Top Chords of Pony Trusses -- Lu-Shien Hu . . . . .	465
ENGINEERING, ELECTRICAL	
Measurement of the Velocity of Propagation of Sound Wave in the Ocean as a Continuous Function of Depth -- Richard Kemp Brown . . . . .	466
Noise Study on Electrical Power Systems with Special Reference to Superimposed Signalling -- Woo Fong Chow . . . . .	466
Scattering and Absorption of Water Droplets at Millimeter Wavelengths -- Chiao-Min Chu . . . . .	467
Synthesis of a Resistance -- Capacitance Filter Whose Power Insertion Ratio Approximates a Prescribed Function of Frequency -- Noah Herbert Kramer . . . . .	468
Utilization of Reflections from Transmission Line Elements to Produce Positive Electrical Pulses of 0.006 Microseconds Duration at High Repetition Rates -- Frank Murray Pelton . . . . .	468



ENGINEERING, ELECTRICAL -- cont'd.	Page
The Fusing of Ceramic Colors Onto Glass by Dielectric Heating -- Queenie Halford Shirley. . .	468
The Opening of the Proportional Region to Beta Counting and the Development of Two Flow Beta Counters -- Ernest Henry Wakefield . . . . .	469
ENGINEERING, MECHANICAL	
An Analytical Study of the Die Casting Process -- Bruno Sachs . . . . .	469
Investigation of the Effects of the Engine Mechanisms on the Torsional Vibrations of Crankshafts -- Chang-Kaing Tsai . . . . .	470
ENGINEERING, METALLURGICAL	
A Study of the Dissolution of Titanium in Acids with Ammonium Fluoride Added -- Charles Burroughs Gill . . . . .	471
The Influence of Phosphorus on Internal Shrinkage and High Temperature Tensile Properties of Alloy Gray Iron -- John Charles Hamaker, Jr. . . . .	471
An Investigation of the Deformation Textures of Titanium -- Dean Nesbit Williams . . . . .	472
ENGINEERING, MINING	
The Mineral Position of Canada -- John Stanley Carman . . . . .	473
ENGINEERING, MECHANICS	
The Turbulent Boundary Layer in the Inlet Region of Smooth Pipes -- James Stafford Holdhusen . . . . .	473
MATHEMATICS	
Asymptotic Properties of Ideal Linear Estimators -- Carl Allen Bennett . . . . .	474
Transfinite Type Theory -- Enrique Bustamante-Llaca . . . . .	474
On Homogeneous Measures and Operator Decompositions of Hilbert Space -- Joshua Chover . . . . .	475
Block Ideals and Arithmetics of Algebras -- William Elliott Jenner . . . . .	475
Contributions to the Theory of Games and Statistical Decision Functions -- Jack Carl Kiefer . . . . .	476
New Metric Properties of Spherical and Elliptic Spaces -- William Lee Stamey . . . . .	476
Certain Applications of Irreducibility to Connected Hausdorff Spaces -- David D. Strebe . . . . .	477
On Linear Differential-Difference Equations and Exponential Sums -- Hermann V. Waldinger . . . . .	477
A Characterization of Certain Topological Spaces by Means of Their Groups of Homeomorphisms -- Martin T. Wechsler . . . . .	478
PHYSICS	
The Effect of the General Mixed Beta Interaction on the Shape of Forbidden Beta- Spectra and on the Beta Angular Distributions Functions -- Mohammed Kashif Al-Ghita . . . . .	479
Production of Charged $\pi$ Mesons in H, D, C, and Pb by 381 Mev Protons -- Martin Moses Block and Sidney Passman . . . . .	479
A Study of the Beta Ray Spectra of Certain Artificially Produced Radioactive Elements with a Lens Type Spectrometer -- George Edgar Bradley . . . . .	480
Magnetic Hyperfine Structure in Diatomic Molecules -- Robert Alan Frosch . . . . .	480
A Cloud-Chamber Investigation of the Multiple Scattering of Low-Energy Protons in Gases -- Eugene Henry Gerber . . . . .	481
Isotopic Masses of Palladium, Cadmium, Indium, Tin, Tellurium, Iodine, and Xenon -- Richard Emerson Halsted . . . . .	481

PHYSICS -- cont'd.	Page
Total Cross Section Measurements for 85 Mev $\pi^-$ Mesons on Hydrogen and Several Other Nuclei -- Peter Judah Isaacs . . . . .	482
The Methyl Alcohol Molecule and its Microwave Spectrum -- Eugene Vasily Ivash . . . . .	483
Beta Ray Spectra of He <sup>6</sup> , O <sup>15</sup> , F <sup>17</sup> and Ne <sup>23</sup> -- Victor Perez-Mendez . . . . .	483
Thermionic Emission and Electron Diffraction from Thin Films of Barium Oxide On Nickel -- Paul Nelson Russell . . . . .	483
Some Experiments on Beta-Gamma Angular Correlation -- Irving Shakhov . . . . .	484
The Experimental Determination of Cross Section Per Unit Solid Angle for the Elastic Scattering of Deuterons by Tritons and the Elastic Scattering of Protons by Deuterons as a Function of Scattering Angle and Incident Deuteron Energy -- William Robert Stratton . . . . .	484
A Study of the Thermoelectric Effect and the Electrical Conductivity of (BaSr) O and BaO -- James Roger Young . . . . .	484
WOOD TECHNOLOGY	
An Investigation of Methods of Improving the Bonding Qualities of Soybean Glue -- Ying-chang Cheo . . . . .	485
RELIGION	
The Moravian Diaspora: A Study of the Societies of the Moravian Church Within the Protestant State Churches of Europe -- John Rudolf Weinlick . . . . .	486
SOCIAL SCIENCES	
ANTHROPOLOGY	
The Toltecs and Their Influence on the Culture of Chichen Itza -- Bertha Pauline Dutton . . . . .	487
An Anthropological Analysis of the Problem of Chronic Diseases Among the Thonga Peoples of Southeast Africa: A Case Study in Applied Anthropology -- Antonio Jose de Liz Ferreira . . . . .	487
The Religion of an Amazon Community: A Study in Culture Change -- Eduardo Eneas Galvão . . . . .	488
AGRICULTURAL ECONOMICS	
Problems in Measuring and Analyzing Marketing Margins for Selected Fruits and Vegetables -- Herbert Wayne Bitting . . . . .	489
Historical Development and Evaluation of the Farm Management Service Associations in the United States -- Milton Lloyd Manuel . . . . .	490
BUSINESS ADMINISTRATION	
Elementary Accounting for General-Business Students -- Charles William Bastable, Jr. . . . .	490
Some Economic Effects of Marketing Research -- Stewart Henry Rewoldt . . . . .	491
ECONOMICS	
Inventories and the Business Cycle with Special Reference to Canada -- Clarence Lyle Barber . . . . .	492
Banking Policy and Economic Development: A Brazilian Case Study -- Morris Bornstein . . . . .	492
Coordination in Canadian Federal Finance -- Harvey Elliot Brazer . . . . .	493
Polity and Economy: An Interpretation of the Principles of Adam Smith -- Joseph Cropsey . . . . .	494
Incidence of Advertising Cost -- Ruth Hoffman Engle . . . . .	494
The Effect of Trade Associations Upon Competition in Selected Industries -- Thomas George Gies . . . . .	495

## ECONOMICS -- cont'd.

	Page
The Competitive Position of the Minnesota Soybean Producer and Processor -- Ray Allan Goldberg . . . . .	495
State Banks and the Economic Development of the West, 1830-44 -- Carter Harry Golembe . . .	496
Public Poor Relief in America, 1790-1860 -- Benjamin Joseph Klebaner . . . . .	497
Post War Price Determination in the Wisconsin Canning Industry: Theory and Practice -- Charles Williams Miller . . . . .	498
The Development of Central Banking in Italy: A Study of Structural Growth and Credit Control -- Anthony Louis Sancetta . . . . .	498
Manpower Resources in a Tight Labor Market -- Kenneth Edward Schnelle . . . . .	499
Alternative Monetary Interest Theories: A Comparison and Evaluation -- Warren Lounsbury Smith . . . . .	499
The New Orleans-Houston Port Rivalry -- Earl Charles Thibodeaux . . . . .	500
Atomic Energy Control and Promotion -- Richard Alton Tybout . . . . .	501
Public Regulation of the Fluid-Milk Industry in Detroit, Michigan -- Jared Scudder Wend . . . .	501

## EDUCATION

The Development and Utilization of the High School Equivalency Certificate in Missouri -- Neil Clay Aslin . . . . .	502
Immature Ego Development as a Factor in Retarded Ability to Read -- Lucille Knecht Barber .	503
An Experimental Study to Determine the Effectiveness of Two Different Methods of Teaching Tennis -- Lua Stewart Bartley . . . . .	503
Determining Validity of the Incomplete Sentences Blank Through Appraisal of Qualitative Interpretations -- Wilbert Arthur Berg . . . . .	504
Private Trade Schools Operating in Missouri, 1944 Through 1951 -- Herman Leon Bibb . . . . .	505
The Organization of a Public Community College Program in Relation to Postsecondary Educational Interests and Needs in an Industrial Community -- Myrtle Foster Black . . . . .	506
Measures of Cost of Post War School Buildings -- Charles Harold Connolly . . . . .	506
An Analysis of an Aspect of Counselor Style by Topical Discussion Units -- Wilbert J. Dipboye . . . . .	507
Certain Factors Related to Teacher Education in the Degree-Granting Institutions of Missouri -- Leland Harry Erickson . . . . .	507
Relation of Physical, Mental, and Clinical Characteristics to the Biological Profiles of Seemingly Satisfactorily Adjusted Adolescents -- Betty Jane Ganzhorn . . . . .	508
Relationship Between Physical Skills and Growth in Elementary School Children -- Louis Anthony Govatos . . . . .	509
The Contribution of Richard Elwood Dodge to Educational Geography -- Paul Francis Griffin . . . . .	510
A Study of the Trends in the Certification of Secondary-School Teachers of Art and in the Objectives of Such Teaching -- Cleobelle Harrison . . . . .	511
Relation of Parental Authoritarianism to the Adjustment of Home-Resident College Students -- Arthur Louis Henze . . . . .	511
Relationship Between Various Factors and Types and Frequencies of Problems Brought to Vocational Homemaking Teachers in Seventy-Seven Michigan High Schools -- Eunice Elizabeth Herald . . . . .	512
Design and Evaluation of an In-Service Training Program for Teachers in Child Growth and Development -- Walter Sulo Holmlund . . . . .	512
A Program of Physical Education for India -- Arthur Wesley Howard . . . . .	513
Status and Trends in Graduate Industrial Teacher Education in the United States -- Roderick George Kohler . . . . .	513



EDUCATION -- cont'd.	Page
An Analysis of the Activities, Training, and Opinions of Coordinators of Cooperative Vocational Education -- George Emmitt Kohrman . . . . .	514
A Study of Selected Curriculum Practices in American Secondary Education Which May Have Significance for the Taghiz School for Girls in Damascus, Syria -- Marzia Abdul-Hamid el-Kouatly . . . . .	515
A Comparative Survey of Samples from the Junior and Senior Population of the College of Education and the College of Arts and Sciences, University of Missouri, Winter Semester, 1950-1951 -- Robert T. McKibben . . . . .	516
Conditions of Faculty Service in Mid-West Jesuit Colleges and Universities -- Jerome John Marchetti . . . . .	517
A Study of Reading Ability in its Relation to the SRA Primary Mental Abilities Test -- Francis Norwood Marquis . . . . .	518
The Origin and Development of Secondary School Accreditation in Missouri from 1888 to 1920 -- Floyd Laverne Mullinix . . . . .	519
An Analysis of the Communication Needs of High School Seniors in a Selected Secondary School -- John A. Munski . . . . .	520
An Experimental Study to Determine Standards of Organic Development for Use in the Boys' Physical Education Program in New York State Secondary Schools -- Saul Ostrow . . . . .	520
José Pedro Varela and His Contribution to Education in Uruguay -- Italo L. Ponterotto . . . . .	521
The Academic Backgrounds of Agricultural Extension Workers as Related to Selected Aspects of Work Adjustment -- Albert Conrad Posz . . . . .	522
The Educational and Vocational Plans of Senior High School Students with Special Reference to the Occupational Pattern of the Community, the Occupations of High School Graduates, and the Terminal Curriculum of the Junior College -- Louis William Redemsky . . . . .	523
The Opinions of the Chief State School Officers in Missouri as to State School Administration -- George Sylvester Reuter, Jr. . . . .	523
A Study of the Readiness of American Baptist Theological Students Holding Opposing "Fundamentalist" and "Modernist" Theological Views to Associate in Religious Groups with Those Differing from Themselves -- Harold Wellington Richardson . . . . .	525
Educational Needs and Interests of People Concerning the Selection, Operation, and Care of the Automobile -- Elmer Robert Rudiger . . . . .	525
Professional In-Service Improvement of Teachers in Missouri -- Robb Lillard Shanks . . . . .	526
The Relationship of Reading Ability to Measures of Perceptual Span with Special Reference to Tachistoscopic Span for Digits -- Roy Elmer Sommerfeld . . . . .	527
Hope College in Dutch-American Life, 1851-1951 -- Preston Jay Stegenga . . . . .	528
A Study of the Relation Between the Equipment of Commercial Teachers and the Demands of Their Teaching Situations -- John Melvin Trytten . . . . .	528
A Study to Determine Why Freshman Scholarship Students at Michigan State College Fail to Renew Their Scholarships -- Marvin Chesley Volpel . . . . .	529
Elementary Mathematics in Arts Colleges -- Howard Elmer Wahlert . . . . .	530
Relationship of Eye-Hand Coordination in Children to Total Development -- Wilbur Allen Williams . . . . .	530
A Synthesis and Evaluation of Subject-Matter Topics in Mathematics for General Education -- Lauren Gayle Woodby . . . . .	531
A Study of Some Health Misconceptions of Prospective Teachers in Negro Colleges of North Carolina -- Maude Josephine Yancey . . . . .	531
<b>EDUCATION AND PSYCHOLOGY</b>	
A Personality Study of Individuals with Seen and Unseen Physical Handicaps -- James Barron . . . . .	532

## EDUCATION AND PSYCHOLOGY -- cont'd.

The Role of Sexual Impotence in the Concept of Self in Male Paraplegics -- Stanley Berger . . .	533
Management of Anxiety in Anxiety Neurosis and Paranoid Schizophrenia -- Murray Blacker . .	533
The Use of the Minnesota Teacher Attitude Inventory in Appraising Counselor Attitudes -- Mabel Kuncze Gibby . . . . .	534
Curriculum Changes in Public Secondary Schools of Missouri, 1890-1950 -- Calvin Edward Harbin . . . . .	535
Types and Frequency of Senior High School Guidance Problems: Their Implications for the Training of Counselors -- Donald Sellers Klopp . . . . .	536
The Effect of Failure in Similar and Dissimilar Tasks on the Continuation of a Problem Solving Set -- Cynthia Lewin . . . . .	537
A Study of the Transfer Effects of Synthetic Flight Training in Naval Air Advanced Training -- Walter Robert Mahler. . . . .	538
An Investigation of the Personality Factors of Dependency and Overcompensatory Goal Striving Behavior Associated with the Development of Peptic Ulcer in a Group of Veteran Male Patients -- Irving Raifman . . . . .	539
An Experiment in Reducing the Informational Dimension of Prejudice -- Zachariah Subarsky . . . . .	539
The Relationship of Personality Characteristics to Measured Interests of Women Teachers of English, Social Science, Mathematics, and Physical Science in Certain Senior High Schools -- Francis Joseph Tomedy . . . . .	540
A Normative Study in Preadolescent Finger-Painting Projection -- Carlotta Sommers Trussell . . . . .	541

## HISTORY

The Role of the Civil Engineer in Internal Improvements: The Contributions of the Two Loammi Baldwins, Father and Son, 1776-1838 -- Frederick Kendall Abbott . . . . .	542
James Gillespie Birney: Exponent of Political Action Against Slavery -- Betty Lorraine Fladeland . . . . .	542
The Philippines, Commonwealth to Republic: An Experiment in Applied Politics -- Part I: The Economic Bases -- Charles Orville Houston, Jr. . . . .	543
Nationalism in Elementary Schoolbooks in the United States from 1776 to 1865 -- Ruth Virginia Miller . . . . .	544
University Representation in England, 1604-1690 -- Millicent Barton Rex . . . . .	545
The German Episcopate under Emperor Henry VI -- Raymond Henry Schmandt, Jr. . . . .	545
The National Association of Manufacturers: Organization and Policies, 1895-1914 -- Albert Kleckner Steigerwalt, Jr. . . . .	546
Richard Wagner's Ideas on Nationalism, Culture, and Religion -- Alice Stuart Tirrell . . . . .	546
The Challenge of the Working Class Reader in Great Britain 1790-1848 -- Robert Kiefer Webb . . . . .	547

## HOME ECONOMICS

Effect of Cooking Temperatures on the Quality and <u>in Vitro</u> Digestibility of Beef Stews and Pot Roasts -- Ellen Bek Freeman . . . . .	548
--	-----

## POLITICAL SCIENCE

Some Aspects of Voting Behavior in Flint, Michigan -- A City with Nonpartisan Municipal Elections -- Carroll Hamilton Clark . . . . .	549
Parliamentary Control of the British Nationalized Industries -- Robert Younger Fluno . . . . .	549
The Publicists and Laissez Faire Constitutional Principles -- Clyde Edward Jacobs . . . . .	550
Commentaries on the Constitution, 1865-1900 -- Charles Edward Larsen . . . . .	551
Fiscal Capacity and State Aid in Michigan Counties -- James Edward Larson . . . . .	551

**POLITICAL SCIENCE -- cont'd.**

- The Hellenic Constitutional Crisis, 1915 -- Achilles Nicholas Sakellarides . . . . . 552
- India's Policy in the United Nations with Special Respect to the Maintenance of  
International Peace and Security (Being a Study of Selected Questions, Disputes  
and Situations.) -- Shanti Narayan Varma . . . . . 552

**PUBLIC ADMINISTRATION**

- Municipal Regulatory Licensing: A Study of Sixteen American Cities --  
Blanche Davis Blank . . . . . 553

**SOCIOLOGY**

- Cooperative Group Formation: A Problem in Social Engineering -- James Cooke Brown . . . . . 553
- A Scale for the Measurement of Group Cohesiveness -- Bernard Goldman . . . . . 554
- The Dynamics of Tolerance: A Study of Social and Psychological Factors in the  
Development of Ethnic Attitudes Among Certain College Students -- Jerome Himelhoch . . . . . 555
- Some Statistical Patterns of Marriage in the United States -- Paul Harold Jacobson . . . . . 556
- On the Differentiation of Ecological Units -- Leslie Kish . . . . . 556



## BIOLOGICAL SCIENCES

### AGRICULTURAL AND BIOLOGICAL CHEMISTRY

#### A STUDY OF SOME PHYSICAL AND CHEMICAL CHANGES ASSOCIATED WITH THE STORAGE OF POULTRY MEAT

(Publication No. 3642)

Milo Harland Swanson, Ph.D.  
University of Minnesota, 1952

A total of 367 birds (chickens), including fryers, roasters, and fowl, were processed and packaged in nine different wrapping materials and then held in frozen storage at 0 deg. F. for periods of 551 to 981 days. There was a close correlation between weight loss and other changes measured, i. e., freezer burn, color and bloom, and organoleptic score. The greater the weight loss, the more extensive the freezer burn, the poorer was the color and bloom, and the lower the organoleptic score. Polyethylene, Cry-O-Rap, aluminum foil, laminated foil, and Pliofilm were satisfactory wrapping materials for frozen poultry held under the conditions and for the periods of this study. Freezer paper, waxed cartons, cellophane, and locker paper did not prove satisfactory. Taste panel scores indicated that changes in storage which could be attributed to type of wrapping material were largely confined to the surface areas of the birds. Mean scores for aroma, color (appearance), and skin (flavor and tenderness) as determined for two different packaging methods were more likely to be significantly different than the mean scores for thigh and breast flavor and juiciness.

An attempt was also made to follow certain protein changes during frozen storage. Ten fowl were dressed and eviscerated and then held at -20.5 deg. C. for a period of forty weeks. Samples of breast and leg muscle were taken from each fowl immediately following evisceration and again at 8-week intervals during the storage period. The following determinations were made on each sample: moisture; total nitrogen; water soluble nitrogen; non-precipitable nitrogen; soluble free alpha-amino nitrogen; and non-precipitable alpha-amino nitrogen. Proteolysis was indicated during frozen storage by increases in soluble nitrogen and non-protein nitrogen of both leg and breast muscle. Decreases in amino nitrogen suggest that certain metabolic processes must be continuing in the frozen state causing further breakdown of the amino acids formed by proteolysis. The rate of amino acid loss was greater at certain stages of the storage period than the rate at which free amino nitrogen was formed through proteolytic activity.

The enzyme system believed to be responsible for proteolysis of poultry meats during storage was studied and partially characterized. Assay for proteolytic activity was based on measuring by spectrochemical analysis the increase in non-precipitable

nitrogen. Optimum pH for hemoglobin hydrolysis was 3.25 to 3.50, and for autolysis of the enzyme preparation itself, maximum activity was at a pH of 3.50 to 3.75. However, prolonged autolysis (10 days) showed that there was considerable proteolytic activity over a pH range of 2.1 to 6.5. The enzyme system was heat labile. Holding the enzyme preparation for 15 minutes at 50 deg. C. had little effect on its activity, but holding it at 60 deg. C. for the same period reduced its activity by as much as 75%. Holding at 70 deg. C. virtually completed inactivation. Dialysis had little or no effect on activity. Cysteine and cyanide both activated the enzyme system. Increases were marked for autolysis but only slight for hemoglobin hydrolysis. p-Chloromercuribenzoic acid had an inhibiting effect on autolysis but not on hemoglobin breakdown. Neither did iodoacetic acid affect hydrolysis of hemoglobin. At temperatures above 20 deg. C. the energy of activation for the system was about 13,000 cal./mole. Below this temperature level, there was a gradual increase in the energy of activation value. Between 0 deg. C. and 10 deg. C. it was approximately 25,000 cal./mole.

Microfilm copy of complete manuscript of 111 pages, \$1.39. Enlargements 6" x 8", 10¢ per page.

### AGRICULTURE

#### STUDIES ON THE EFFECT OF SOME ENVIRONMENTAL CONDITIONS AND CHEMICALS ON THE DEVELOPMENT OF PUCCINIA GRAMINIS AVENAE ERIKSS. AND HENN.

(Publication No. 3947)

Ismail Ali Ibrahim, Ph.D.  
University of Minnesota, 1952

For 2 decades prior to 1943, races 2 and 5 of *Puccinia graminis avenae* were the only races sufficiently prevalent in the United States to be important. Then came race 8 in 1943 and race 7 in 1950.

Available sources of stem-rust resistance in oats are: the Richland, the White Tartar, and the Hajira strain. Varieties with Richland parentage are susceptible to race 8, and those with White Tartar parentage are susceptible to race 7. Resistance of the Hajira strain is not maintained under all environmental conditions. Effort was made, therefore, to study the variability of rust development in important oat-variety x rust-race x environment combinations.

Temperature caused wide variability in rust reaction to races 6, 7, and 8 of varieties with the Hajira type of resistance, such as Garry, Hajira x Joannette, and Victoria x (Hajira x Banner); on the other hand,

varieties with the Richland or the White Tartar types of resistance, such as Andrew or Mindo, were remarkably stable in their seedling reaction to these races over a temperature range of 70° to 90° F.

Varieties with the Hajira parentage were resistant to races 6, 7, and 8 at temperatures below 75° F.; at 80-85° F. they were susceptible to race 6 but still resistant to races 7 and 8; and at 90° F. they were susceptible to the three races.

High temperature (80-85° F.) exposure for at least three days prior to and after rust inoculation was required to induce a change in reaction of Garry and Hajira x Joannette from resistance to susceptibility to race 6, but storage of germinated seeds of Andrew, Mindo, and Garry at 1° C. for as long as 6 weeks did not affect their resistance to races 6, 7, and 8.

Hybrid lines with Richland x Hajira or White Tartar x Hajira parentage did not maintain their resistance to races 7 and 8 both, at 90° F. Richland x Hajira hybrids were resistant to race 7, but susceptible to race 8, whereas White Tartar and Hajira crosses were resistant to race 8, but susceptible to race 7.

Fertilization with nitrate or ammonium in equal amounts of nitrogen (up to 420 p.p.m.) did not influence seedling reaction of Andrew, Mindo, and Garry oats to races 6, 7, and 8. The rust races sporulated more abundantly and the host plants grew more vigorously when supplied with nitrate than with ammonium.

Excess boron, copper, zinc, manganese, or molybdenum, added to a complete nutrient solution, in tolerable concentrations, did not appreciably influence the reaction of Andrew and Mindo to races 7 and 8, although excess boron or copper promoted vigorous growth of the plants and abundant sporulation of the rust races.

Lack of either nitrogen, potassium, phosphorus or sulfur in nutrient solutions reduced the vigor of Andrew, Mindo, and Garry plants and also reduced sporulation of races 6 and 7. However, uredia larger than normal and without sharp necrosis were produced by race 7 on Andrew and Garry plants lacking calcium or magnesium.

The number of uredia was considerably reduced on Andrew plants sprayed in the field with 1000 p.p.m. 2,4-D emulsion, but the rust infection type was not changed.

A 200 p.p.m. DDT solution reduced the number of uredia of races 6, 7, and 8 when it was sprayed 3 days before inoculation on Andrew, Mindo, and Garry plants while application 3 days before or after rust inoculation did not affect rust reaction. Indole acetic acid up to 0.6 p.p.m. in the soil did not affect any phase of the development of race 8 on Garry and Bond.

Certain rust races survived better than others when grown together in mixture with another race for successive generations. Race 7 predominated through successive generations on Bond in mixture with either race 2 or 8 and, likewise, race 8 predominated when grown in mixture with race 6. After 13 or 14 generations the weaker race in the mixture was eliminated completely.

Microfilm copy of complete manuscript of 91 pages, \$1.14. Enlargements 6" x 8", 10¢ per page.

# VARIABILITY IN RESISTANCE OF CERTAIN WHEAT VARIETIES TO *Puccinia graminis* *tritici* RACE 15

(Publication No. 3641)

Tapa Nath Shukla, Ph. D.  
University of Minnesota, 1952

The rapid increase of race 15B of *Puccinia graminis tritici* in the wheat stem rust population within North America and the role of this race in the destructive stem rust epidemic on durum and spring wheats in the United States in 1950 emphasized the need for information on the pathogenic capabilities of race 15 and its biotypes and the need for knowledge of the variability in stem rust reaction in new commercial wheat varieties and in breeding materials. Thus a study was made of the effects of certain environmental factors, among which temperature and light were the principal variables, on the reactions of Lee, Kenya 58, Kenya 117A, Frontana, Marquis, Mida, Newthatch, Mindum, and Stewart wheats to races 15 and 15B of *Puccinia graminis tritici*. The relative virulence of these races also was studied on some barley, rye, and oat varieties and on several grasses.

Marquis, Mida, Mindum, and Stewart wheats were susceptible to races 15 and 15B in all the environments tested. A temperature range of 60°-98° F. did not affect the susceptibility of these varieties except that the higher temperatures permitted faster and better rust sporulation whereas the lower temperatures delayed rust development. Light intensity ranging from 1000 to 6000 foot candles and day lengths of 4 to 14 hours influenced the rate and amount of rust sporulation but did not change the susceptibility. Application of complete nutrient solution increased sporulation somewhat but did not change the rust reaction. Similarly the resistance of Lee to 15 and its susceptibility to 15B, and the moderate susceptibility of Frontana to both the races were not changed in different environments, whereas K117A and K58 varied in their rust reactions. Between 60° and 80° F. the Kenyas were resistant to both races. If, however, the post-inoculation temperatures were 85° F. or higher, the Kenyas were susceptible to 15 and moderately susceptible to 15B. High temperatures during the daytime only, however, were insufficient for the expression of susceptibility to 15B; if night temperatures were consistently below 70° F. the Kenyas were moderately resistant to race 15B. Newthatch also was resistant to 15 at 60°-65° and 70°-75° F. but susceptible at 80°-85° F. Reaction of Newthatch to 15B, however, was not changed appreciably by temperature.

Light as well as temperature determined the reaction of Kenya seedlings to races 15 and 15B but the effect of light was on different phases of rust development. With a light intensity of 100 foot candles or less the rust mycelium grew abundantly at 80-85° F.



or higher temperatures but the sporulation was poor. With 1500 foot candles and again at the high temperature the rust grew and sporulated moderately well, with only limited injury to the host cells. When light intensity was 3500 foot candles or more, however, the better sporulation of race 15B on Kenya seedlings was limited in part by the rapid chlorosis and necrosis of host cells in the infected areas.

Short duration of light, as well as low intensity, retarded host-cell injury and reduced chlorosis and necrosis. A 4-hour-day with light intensity of 3000 foot candles and a temperature of 80°-85° F. or higher permitted race 15B to sporulate well and to cause only limited necrosis of Kenya host tissue. With 8- and 14-hour days necrosis of the host cells was very pronounced.

The higher light intensities and the longer days also hastened the general leaf tip necrosis associated with 15B infection on the Kenyas, while a light intensity of 100 foot candles or a day of 4 hours reduced the necrosis or prevented its appearance. Temperature had very little effect on the general necrosis.

The few experiments with adult plants indicated that the Kenya wheats possessed a "mature plant-resistance" to 15B that was not altered by temperatures of approximately 85° F. or higher.

The host range of races 15 and 15B was greater than that previously reported for *P. graminis tritici* and its races in that four collections of *Agropyron repens* grown from seed and one collection of the same species grown from portions of rootstocks were susceptible in both seedling and adult stages.

Microfilm copy of complete manuscript of 78 pages, \$1.00. Enlargements 6" x 8", 10¢ per page.

## AGRONOMY

### SOME PLANT BREEDING STUDIES WITH TALL FESCUE (*FESTUCA ARUNDINACEA* SCHREB.)

(Publication No. 3634)

John Ritchie Cowan, Ph. D.  
University of Minnesota, 1952

This study was conducted to determine some facts about the breeding behavior of tall fescue. This grass has received considerable attention during the last decade, as a result of the distribution of the two ecotype selections K.31 and Alta.

An investigation of the flowering habit yielded some useful information for the plant breeder. There is a period of ten days from the time at which the panicle emerges, before there is any danger of flowering. It flowers usually in the afternoon and occasionally very early in the morning. The time of day at which flowering takes place seems to be governed more by the prevailing temperature and humidity than by photoperiodism. It is possible to bulk emasculate by the hot water method using 46° C for

three minutes. There is a reduction in seed set on treated panicles, which is probably due to damaged embryos.

When several hundred plants were checked for their self-fertility, self-sterility was found to be predominate. Self-fertility was measured, as a ratio of the self seed to open-pollination seed, expressed as a percentage. Clones classified as highly self-sterile on two years data produced seed in every case, when crossed in all possible single crosses. The fact, that these highly self-sterile clones set seed upon crossing, would suggest self-incompatibility as a possible cause of the self-sterility.

It was found that tall fescue could be multiplied readily asexually. An average two year old plant will produce two hundred clones. Clones made from stem cuttings taken at the base of the culm, having one node, established themselves very well. One of these clones started in the greenhouse in August, and transplanted to the field in October, will produce fifty more clones by the subsequent August.

In 1949 very striking intra-plant variations of self-fertility measures were noted, when more than one measure per plant was made. In 1950 and 1951 very intensive experiments were conducted, to determine the number of samples and the number of panicles within a sample, necessary to give a reliable estimate of self-fertility on any one plant. Results of these studies indicated that three (two or four panicle) samples per plant should be sufficient.

Variability of seed and forage yield among several hundred plants was investigated. It was found that seed production varied from plants having practically no seed per panicle, to those having one and one-half gram of seed per panicle. On individually spaced plants there was a significant increase in seed production from the first seed year to second. Forage estimates of yield were made visually in March, August and October. Although in a few cases some plants behaved the same at all three dates, in general they did not.

The effects of selfing were quite evident in the first inbred generation of ten clones studied. They did not withstand adverse weather as well as the mother clones, nor did they produce as much seed and forage. The  $S_1$  progeny showed considerable variability in vigor in their  $S_2$  seedlings.

Microfilm copy of complete manuscript of 93 pages, \$1.16. Enlargements 6" x 8", 10¢ per page.

### A STUDY OF THE INTER-RELATIONSHIPS OF SEED YIELD, OIL CONTENT AND OTHER AGRONOMIC CHARACTERS WITH SUNFLOWER INBRED LINES AND THEIR TOP CROSSES

(Publication No. 3959)

Wilbert Ambrick Russell, Ph. D.  
University of Minnesota, 1952

This study was designed to determine relationships between plant characters of sunflower inbred



lines and their performances in top-cross combinations. The experiment was planned, also, to investigate the association between oil content of the whole seed and various seed characters. Selection for high oil content is equally as important as the development of higher yielding hybrids.

The data for plant characters were obtained from 54 inbreds and their top crosses in 1949 and 47 inbreds and their top crosses in 1950. Studies for oil content and other seed characters were made on seed from 62 inbred lines and 36 top crosses in 1949, and 45 inbred lines and 44 top crosses in 1950.

Highly significant differences were obtained both seasons between the inbred lines and between the top crosses for all plant characters analyzed statistically with the exception of top-cross head diameters which had no significant differences in 1950. None of the top crosses yielded significantly more than the commercial top cross, Advance, in either season.

A highly significant, negative correlation coefficient was obtained in 1950 for the relationship between yield of the top crosses and stalk diameter of the inbreds. Otherwise, no definite associations were found between top-cross yields and inbred plant characters. The multiple correlation coefficient of +0.4712 obtained in 1949 for the relationship between top-cross yields and the inbred characters, yield, leaf area, plant height, days to flowering, days to maturity, stalk diameter, head diameter, rust rating, vigor rating and per cent of lodged plants was not significant. The multiple correlation coefficient of +0.6761 obtained in 1950 for the relationship between top-cross yields and the same inbred characters, with the exceptions of days to maturity and per cent of lodged plants which were not included, was highly significant.

In 1949, there were positive, highly significant correlations between yield of inbreds and the inbred characters, leaf area, plant height, days to flowering, days to maturity, stalk diameter, head diameter and vigor rating. In 1950, the associations of inbred yield with head diameter and vigor rating were positive and significant, while between inbred yield and leaf area there was a positive, highly significant relationship.

Highly significant differences were found between inbreds and between top crosses for per cent of oil in the whole seed. A line developed from Advance significantly exceeded this top cross and both of its parents for oil content in 1949 and 1950. There were positive, highly significant correlations between per cent of oil and per cent of kernel in both inbred tests and in the 1950 top-cross test. No definite relationships were found between oil content and the seed characters, weight per 1000 seeds and weight per bushel. The correlation obtained in the 1950 inbred test between oil content determined by ether extraction and oil content estimated by the appearance and texture of a coarsely ground sample was positive and highly significant.

Oil content in seed of the inbreds had a positive, highly significant correlation with plant height, and a

negative and significant association with rust rating in 1949. In 1950, positive, highly significant correlations were obtained between inbred oil content and the inbred characters days to flowering, leaf area and vigor rating. The relationship between oil content and plant height for the same year was positive and significant.

The results suggested that the tester parent, Sunrise, may contain a large number of the factors responsible for high combining ability and many of these have a dominant, or nearly dominant, behavior. The only lines which showed superior combining ability in the test crosses were those which possessed genes complementary to the genes already present in Sunrise. The results indicated that other methods, such as the use of a synthetic tester variety and the polycross progeny technique, to determine general combining ability of inbred lines should be investigated.

Microfilm copy of complete manuscript of 74 pages, \$1.00. Enlargements 6" x 8", 10¢ per page.

#### AN EVALUATION OF THE PRODUCTION AND ECONOMIC RETURN FROM PASTURES ON A MIDWESTERN CLAYPAN SOIL

(Publication No. 3864)

Darnell Moses Whitt, Ph. D.  
University of Missouri, 1952

The climatic hazards which obtain on the claypan soils of Northeast Missouri encouraged the start of investigations in grassland farming at the Midwest Claypan Soil Conservation Experiment Farm near McCredie, Missouri in 1940. Grasses and legumes were found to be powerful tools for erosion control and soil tilth maintenance, but the extent of their use was and is determined partly by their capacity to compete with grain crops for available cropland. It was the purpose of this investigation to evaluate the production and economic return from several pastures and to compare these returns with some cash grain farming systems under two levels of soil fertility.

The experimental plots were located on Mexico silt loam, formerly classified as the sloping phase of Putnam silt loam, and representative of approximately 10 million acres of midwestern claypan soils. The pasture plots were two acres in size, and production was determined by grazing with one- and two-year-old beef cattle. The plots farmed to the grain systems were 10.5 feet wide and 90 feet long. All of the plots were on a 3-percent slope and were farmed up and down hill. Soil and water loss measurements were made by catchment at the lower ends of the plots or by rate measuring flumes.

The early period of study, 1940-1946, was conducted with nominal applications of fertilizer. One hundred pounds of 0-20-10 fertilizer was applied with each small grain seeding. The pasture plots seeded to grasses received 200 to 400 pounds of

0-20-10 fertilizer when they were established, and 3 to 5 years later began receiving 200 pounds of 0-20-10 fertilizer every other year. Soil treatments in the high-level fertility period, 1947-1951, were applied according to soil tests. This included a basic treatment of phosphate and potash and regular maintenance applications of these elements. Nitrogen fertilizer was applied before corn at rates up to 300 pounds of 33-0-0 per acre, and small grain received top dressings of nitrogen. Certain pasture plots without legumes also received nitrogen fertilizer.

Complete records on all areas permitted the computation of costs of production and returns from the pastures and cropping systems. Prices at two levels were used for this purpose. The lower level was that of the 7-year period 1940-1947, when the beef-corn ratio was 12.6. The higher price level was that of the 5-year period 1947-1951, when the beef-corn ratio was 17.4. Costs of commodities and services used in production, and prices received at central markets for commodities produced, were determined from appropriate statistical sources. No charge was made for land and management in reporting net return.

The cost of producing a bushel of corn equivalent, computed on a net energy basis, was used as a means of eliminating the favorable economic position of beef compared with corn in both price periods.

Nominal amounts of fertilizer gave just as high returns when applied to pastures as to cash grain systems at the lower price level. High-level soil treatments were more remunerative on grain rotations than on pastures at the lower price level. Net return was larger from pastures than from grain systems at the higher price base under both levels of fertility treatments. In general, a bushel of corn equivalent was produced more economically on pastures under both levels of fertility treatments computed at both price levels. Unlimed and unfertilized claypan soil produced larger net returns in native pasture than in a rotation of corn-oats. Only at the higher prices was either level of fertilizer treatment or sweet clover seeding in native Kentucky bluegrass pastures economical. Under high-level mineral soil treatment, Kentucky bluegrass with Korean lespedeza produced higher net return than Kentucky bluegrass which received nitrogen fertilizer.

The data presented support the movement toward a predominantly pasture type of farming on these midwestern claypan soils.

Microfilm copy of complete manuscript of 104 pages, \$1.30. Enlargements 6" x 8", 10¢ per page.

## ANATOMY

### THE PRENATAL DEVELOPMENT OF THE HUMAN FEMUR

(Publication No. 3745)

William Joseph Lawrence Felts, Ph. D.  
University of Michigan, 1952

In spite of the great number of studies in osteology and skeletogenesis, almost nothing has been reported concerning the prenatal growth of human long bones and the relation of this growth to the basic histogenetic processes. This is especially true in regard to the long bones as entities in the dimensions other than length. Because of this lack and because of the particular interest that has been shown in the femur in the literature, a study of the prenatal development of this bone was made.

The material used consisted of 53 femurs (shaft lengths, 8 mm to 110 mm) from fetuses and neonates of ages ninth fetal week to third week postnatal. Femurs were stripped to periosteum and cartilage, cleared to demonstrate ossification and photographed. Measurements were taken from line drawings of constant size of the frontal, superior, inferior and medial aspects. Major dimensions of the ossified shaft and the proximal and distal cartilages were measured and their values plotted on log-log graphs after the method of Huxley ('32). Rates of growth or increase relative to shaft length were expressed by Huxley's coefficient of growth, variation by correlation coefficients.

It is concluded from these data, and by relating the changes to known histogenetic processes, that the major growth characteristic of the prenatal femur is the increase in robustness as the result of the rapid transverse growth of the cartilage masses at either end of the ossified shaft. Bone, increasing in diameter only by opposition, replaces the cartilage which has increased by both interstition and apposition. The ossified portion of the shaft, then, assumes ever greater diameters of the femur as it replaces cartilage. Thus, although not increasing overall femoral length, osseous replacement of rapidly growing cartilage determines femoral shape.

Projection of prenatal growth trends into the postnatal period and the comparison of these with the actual dimensions and indices of a femur indicates that there must be a shift in the direction of predominate growth sometimes in the circumnate period. In the prenatal period transverse growth seems predominating; in the postnatal the opposite, longitudinal, is true. A causal complex for this change is suggested.

Particular attention is paid the angular dimensions of torsion, displacement of the head, inclination of head and neck, and obliquity of the shaft. These dimensions, on the basis of high variability, are classified as environmentally influenced (if not determined). In this series, all the angles except obliquity increase. Fetal torsion, especially near



term, far exceeds the adult values, as has been observed by others. No explanations for angular changes are offered.

In this paper, all data are presented in tabular form in addition to graphic expression.

Microfilm copy of complete manuscript of 108 pages, \$1.35. Enlargements 6" x 8", 10¢ per page.

#### PATTERNS OF CARDIO-THORACIC VENOUS DRAINAGE IN THE RAT

(Publication No. 3601)

Myron Herbert Halpern, Ph.D.  
University of Michigan, 1952

This investigation deals with the venous drainage pattern of the thorax and heart of the adult rat and of the development of the cardiac veins. The animals were injected with colored latex and the thoracic and cardiac veins were dissected. Embryos of 13 days to 16 days 14 hours of age were serially studied.

The azygos system is the main venous drainage of the thorax, directly draining the intercostal spaces of the left side; the lower right intercostal spaces empty through the hemiazygos vein into the azygos, and the middle intercostal spaces drain across the midline into the azygos vein. The right upper five intercostal spaces drain through the superior intercostal vein into the right precava. The left upper five intercostal spaces exhibit a more variable pattern, draining into the azygos or the left precava. The first intercostal vein on both sides empties into the vertebral veins. The azygos system bears an important relationship to the sympathetic trunks which is an important fact in the interpretation of the development of the system. The remainder of the thoracic drainage consists of a visceral drainage from the trachea and esophagus to the right precava, and the vertebral venous drainage from the vertebral column plexus.

The cardiac drainage in the adult rat is by cardiac veins emptying into extracardiac vessels. The right side of the conus drains into the left anterior vena cava by way of the conoanastomotic vein, which obliquely crosses the aortic arch. The left side of the conus and the left atrium drain through the conoventricular vein into the right anterior vena cava. Both ventricles are drained by the right, dorsal, and left cardiac veins which terminate in the "coronary sinus." Some individuals exhibit a ventral cardiac vein which anastomoses with the conoanastomotic vein.

The conoanastomotic and conoventricular veins arise embryologically from a venous plexus surrounding the conus and truncus. Differential regression of this plexus forms the adult vessels. The right, left, and dorsal cardiac veins arise subepicardially from cell clusters which canalize to form blood-filled endothelial sacs. Coalescence of these sacs with the endothelial buds from the left common cardinal vein forms the cardiac veins.

The extracardiac veins from the heart represent the primitive, cephalic cardiac veins of primitive vertebrates. The cardiac veins represent the caudal cardiac veins of lower forms. Therefore, in the rat, there are retained many of the primitive features of cardiac drainage that are found in lower forms but which have been lost by other mammals.

Microfilm copy of complete manuscript of 118 pages, \$1.48. Enlargements 6" x 8", 10¢ per page.

#### THE HUMAN EMBRYONIC HEART AT THE BEGINNING OF THE THIRD MONTH

(Publication No. 3782)

Richard Harry Licata, Ph.D.  
University of Michigan, 1952

This paper presents the results of an intensive study of the human heart in the ninth week of development. The selection of this age was determined by the fact that most of the cardiac structures recognized in the adult are at that age clearly established while they yet remain sufficiently embryonic to reflect the developmental processes involved in their origin.

A detailed study was made of the hearts of several serially sectioned embryos in this age range in the University of Michigan Embryological Collection. Wax-plate reconstructions, X100, were made from two of the best preserved specimens, EH 377 (31-5 mm. CR) and EH 164 (25 mm. CR). In addition, microdissections of hearts of other embryos in this age range were carried out for cardiac relations and proportions.

It was found that the external configuration of the heart, even at this early age, is essentially similar to that of the postnatal heart, although its apex is much farther to the left within the thorax.

The interatrial septal complex is of particular interest at this age. There has been extensive secondary resorption of septum primum to form a large ostium secundum. A thick, but not yet extensive, septum secundum delimits a wide foramen ovale. This arrangement leaves a much freer interatrial communication than is characteristic of the fetal heart at term.

The right venous valve is extraordinarily highly developed at this age, whereas the left venous valve has already been considerably reduced. As a result there is a deep sino-atrial bay between the right venous valve and the interatrial septal complex. All the major veins empty into this bay. In contrast, the venous return to the left atrium, by way of the pulmonary veins, is still relatively small. The morphology of this region suggests that a considerable part of the inferior caval blood stream passes directly through the interatrial "functional orifice" into the left atrium. The right venous valve may well act as a baffle helping to insure adequate charging of the left atrium. In the sino-atrial bay there must be considerable mixing of the blood



entering by way of the superior vena cava and the coronary sinus with the part of the inferior caval blood that does not go to the left atrium.

The septum membranaceum is as yet undifferentiated, by the ventricles are completely separated by a composite mass of endocardial cushion of tissue lying along the crest of the interventricular septum musculare. Some of this tissue extends into the atrioventricular valves which are, at this stage, two layered. On their atrial faces they are composed of endocardial cushion tissue and on their ventricular faces they still have a layer of cardiac muscle. The endocardial cushion tissue of this region, together with that lining the atrioventricular orifices, will participate in the formation of the fibrous skeleton of the heart.

The coronary circulation is established early and rapidly in the embryonic heart, so that by the ninth week all of the major cardiac vessels recognized in the adult are present and there are already special branches to the sino-atrial node and to the main atrioventricular bundle.

Both divisions of the autonomic nerve supply to the heart are represented by nine weeks, but the parasympathetic cardiac branches from the vagus are more highly developed than the sympathetic cardiac branches. Local aggregations of neuroblasts are found in many areas in relation to the heart and the great vessels.

A well-defined primordium of the sino-atrial node can be identified by the ninth week. A definite primordium of the atrioventricular node was not established. The bundle of His, and its major branches, is the most strongly developed component of the sinoventricular conduction system at this age.

Microfilm copy of complete manuscript of 156 pages, \$1.95. Enlargements 6" x 8", 10¢ per page.

#### AN ANATOMICAL AND EXPERIMENTAL STUDY OF THE CEREBELLAR NUCLEI AND THEIR EFFERENT PATHWAYS IN THE MONKEY

(Publication No. 3795)

Robert Wheeler Rand, Ph.D.  
University of Michigan, 1952

The anatomical arrangement of the cerebellar nuclei and of their efferent fiber tracts as seen in the macaque are the subject of this study. Localized lesions were produced within the cerebellar nuclei or the superior cerebellar peduncle and the material was prepared by the Marchi technique to provide evidence of the course and termination of the efferent fibers. The normal microscopic anatomy of the nuclei was studied in serial sections stained by the Weil and the Huber toluidine blue techniques.

Heretofore, at least three pairs of cerebellar nuclei have been described by some investigators: nucleus fastigius, nucleus interpositus and nucleus dentatus. In this investigation, such a subdivision is confirmed with the reservation that the more medial

areas of the dentate nucleus at caudal levels become the more lateral portion of the interpositus nucleus in more rostral planes. Furthermore, there are nuclear bridges connecting the nucleus fastigius with the nucleus interpositus at some points. Therefore, at some levels the cerebellar nuclei represent a continuous gray mass of cells and have been molded into various configurations and divisions by massive fiber tracts.

The generally accepted terminations of efferent fibers from the fastigius and dentate nuclei to the brain stem and thalamus have been confirmed. In addition, support is given to some of the terminations which have been in controversy. Hitherto unknown terminations of crossed and uncrossed fibers from the cerebellum to various nuclear masses and areas within the brain stem and thalamus are described and a pattern of termination of the fibers in the brachium conjunctivum ascendens and descendens is presented.

There are a multitude of efferent fibers from the three pairs of cerebellar nuclei. Such fibers may be entirely crossed, or uncrossed, or a combination of both. The scope of their terminations throughout the brain stem and thalamus has been broadened by this study. They are distributed to the thalamic and brain stem centers and, in many instances, terminate directly or indirectly upon the same nuclear mass. In other words, separate portions of one cerebellar nucleus, or two separate cerebellar nuclei which have like function, send fibers to the same brain stem or thalamic center; they may reach such an area directly or after a synapse in course. Consequently, specific nuclear centers within the brain stem or thalamus may receive stimuli from several portions of the same cerebellar area, or from functionally similar cerebellar nuclei. Thus, with destruction of small portions of the cerebellar nuclei, other parts of these nuclei readily compensate so that there is no obvious dysfunction. As the loss of efferent fibers becomes greater with more extensive lesions, more severe and more lasting symptoms develop.

Regions or nuclear masses within the brain stem and thalamus which have multiple connections from such areas as the basal ganglia, cerebral cortex, hypothalamus and cerebellum, and which are therefore under the influence of various centers, have been designated correlating centers and their efferent tracts considered as final common pathways.

The general conclusion reached is that the significance of these correlating centers and their final common pathways is to be found in Tilney's principle of synergia. The combined effective action of the cerebellum and other centers of the central nervous system such as the basal ganglia, brought about in one or more of the correlating centers, produces an appropriate motor action which aids in the "establishment and maintenance of coordination of synergic units" and thus produces normal motor activity.

Microfilm copy of complete manuscript of 135 pages, \$1.69. Enlargements 6" x 8", 10¢ per page.

### STUDIES OF THE SPINAL CORD THREE ASCENDING PROPRIOCEPTIVE SYSTEMS

(Publication No. 3824)

Robert Eugene Yoss, Ph.D.  
University of Michigan, 1952

The purpose of this investigation was to determine the course and pattern of localization, if any, in several of the ascending fiber systems of the spinal cord of *Macaca mulatta*. Fifteen animals were used for these experiments and lesions were placed at various levels of the spinal cords. Representative segments of the spinal cords and brains were stained by the Marchi technique and the fiber tracts were then studied.

In Part I of the present study, a pattern of localization within the macaque dorsal spino-cerebellar tract was determined. This pattern was considerably different from that presented by Sherrington and Laslett ('03) for the dog. In the monkey, the longest fibers of the dorsal spino-cerebellar tract (those from more caudal segments of the spinal cord) shift dorsalward as they ascend toward higher levels. Fibers of intermediate length are located just ventral to the longest fibers and, finally, fascicles from the upper thoracic segments lie in the most ventral portion of the tract at cervical levels. The dorsal spino-cerebellar fibers were traced to the cerebellum where they terminate in the vermis part of the anterior lobe, the pyramid, the uvula and the declive.

In Part II of this thesis, a pattern of localization within the ventral spino-cerebellar tract was determined, which is very similar to that described by other investigators for the lateral spino-thalamic tract. However, the fibers of the ventral spino-cerebellar system are more superficial and slightly more ventromedial than are the components of the lateral spino-thalamic bundle arising from the same segments. As seen in upper cervical cord, the fibers of the ventral spino-cerebellar tract which arise at coccygeal and sacral levels are located in the most dorsolateral part of the tract; fascicles from the lumbar cord lie next to those from sacral levels in the lateral white column; fibers arising from thoracic segments are located in the intermediate part of the bundle; and, finally, the most ventromedial portion of the tract are ventral spino-cerebellar fibers arising from the cervical cord. The ventral spino-cerebellar fibers were traced to the cerebellum where they also terminate in the vermis of the anterior lobe, the pyramid, the uvula and the declive.

Part III is concerned with the pathways within the central nervous system that mediate impulses set up by painful stimulation of tendons. In the monkey, impulses set up by painful stimuli in tendons ascend in the lateral spino-thalamic tract on the side opposite their origin. There is a pattern of localization in the lateral spino-thalamic tract not only for fibers mediating impulses set up by superficial painful stimuli but also for fibers carrying impulses from the painful stimulation of

tendons. Impulses set up in the Achilles tendon by painful stimuli ascend in the most dorsolateral portion of the lateral spino-thalamic tract on the side contralateral to their origin; those aroused by painful stimuli in the wrist tendons ascend over fibers in the more ventromedial part of this contralateral spino-thalamic bundle. Deep pain reaches consciousness at subcortical levels, presumably in the dorsal thalamus.

Microfilm copy of complete manuscript of 110 pages, \$1.38. Enlargements 6" x 8", 10¢ per page.

### ANIMAL HUSBANDRY

#### NUTRITIONAL REQUIREMENTS OF SWINE

(Publication No. 3827)

Gerald Clifton Anderson, Ph. D.  
University of Missouri, 1951

Evidence presented by many investigators indicate that the high mortality rate and poor growth in swine is related to nutritional deficiencies. In this investigation, fourteen trials were conducted in order to study the adequacy of rations composed of purified nutrients and practical feedstuffs for growth and reproduction in swine. This research was conducted during the period from November, 1947 to June, 1950, and it was designed to determine:

1. The adequacy of purified diets for growth and development in swine.
2. The value of certain crude vitamin carriers as sources of unrecognized vitamins required by swine.
3. The effect of an antibiotic, aureomycin, on the growth and well being of suckling pigs.
4. Whether glucose was superior to sucrose as a carbohydrate in purified rations for suckling pigs.
5. The importance of vitamin B<sub>12</sub> in swine nutrition.
6. The adequacy of purified diets for reproduction in swine.

Four separate trials were conducted with purified diets involving 37 pigs. All pigs were removed from their dams at approximately two days of age and were fed the purified diets in the form of an artificial milk. Nine additional pigs were fed a ration of fortified cow's milk, and they acted as controls in these trials. The usual experimental period was 56 days. In some trials the pigs were kept for an additional period and were fed the purified rations in dry form. Four of these animals were maintained through a reproductive cycle on purified diets.

In all trials with suckling pigs, satisfactory growth was recorded, but in each trial those pigs which received the fortified cow's milk grew faster and consumed more feed than did the pigs which received the artificial milk. It is felt that this difference may be attributed to the physical nature of



the artificial milk which may be irritating to the intestinal tract, or that cow's milk contains some essential unrecognized nutrient for the pig.

No evidence was obtained that an antipernicious anemia liver fraction, whole liver extract, whey, or soybean oil meal contained unrecognized nutrients required by the pig. It is felt, however, that whole liver extracts and soybean oil meal should be investigated more thoroughly.

In one trial in which aureomycin, an antibiotic, was investigated, no evidence was obtained that this substance materially enhanced the nutritional state or well being of the pig. The data indicated that the consumption of the antibiotic changed the intestinal flora, appeared to reduce the dietary requirement for vitamin B<sub>12</sub>, and increased the rate of growth to a slight extent.

No evidence was obtained that glucose was superior to sucrose as a carbohydrate in purified rations for suckling pigs.

Vitamin B<sub>12</sub> is a nutritional requirement for satisfactory growth and reproduction in swine. The results of these investigations indicate that when vitamin B<sub>12</sub> is added to purified diets the rate of growth and well being of the pigs is improved. From the data recorded, a tentative requirement of not more than 1.5 meg. of vitamin B<sub>12</sub> per 100 gms. of food has been calculated for the pig. Data from trials conducted with weanling pigs fed practical feedstuffs indicated that such feeds as corn and soybean oil meal are deficient in vitamin B<sub>12</sub> and that this vitamin is a requirement for rapid and efficient growth in swine.

Purified diets were inadequate for reproduction in swine until vitamin B<sub>12</sub> was included in the nutritional regimen. When sows received adequate amounts of this vitamin along with other known required substances, reproduction was completed satisfactorily. A tentative requirement of 11.7 meg. of vitamin B<sub>12</sub> per kilogram of food is offered for the mature brood sow. The inclusion of a whole liver extract in the purified diet did not enhance brood sow performance.

The addition of a vitamin B<sub>12</sub> concentrate to rations composed largely of corn and soybean oil meal improved brood sow performance significantly. Supplements of riboflavin, calcium pantothenate, and nicotinic acid also seemed to improve the rations, but to a lesser degree. Limited data indicated that fresh forage, when consumed in adequate amounts may supply the requirement of the brood sow for vitamin B<sub>12</sub>. An adequate intake of this vitamin by brood sows decreased the mortality and increased the thriftiness and rate and economy of gain of their litters.

Microfilm copy of complete manuscript of 168 pages, \$2.10. Enlargements 6" x 8", 10¢ per page.

## REPRODUCTIVE DEVELOPMENT AND PERFORMANCE OF BOARS FROM CERTAIN INBRED STRAINS AND THEIR CROSSES

(Publication No. 3839)

Edward Richard Hauser, Ph.D.  
University of Missouri, 1952

The gross and histological development of the testis, character of semen and fertility were studied among boars from four strains and their six crosses during four breeding seasons. Inbreeding was approximately 45 per cent and 30 per cent for two Polard China lines, 25 per cent for the Hampshire line and none for the Durocs.

Unilateral castrations of 86 boars at intervals ranging from 10 to 40 days between 125 and 175 days of age caused marked hypertrophy of the second testis weight when the interval after first castration was 20 days or more and when boars were 165 days of age or older at second castration. Between 125 and 175 days, body weight increased by 1.65 times; testis weight by 4.5 times; epididymis weight by 2.3 times; diameter of seminiferous and epididymal tubules by 1.5 and 1.3 times, respectively; but little change occurred in distance between seminiferous tubules and none in shape of testis. Extension of tubules accounted for much of testis growth. Size of epididymis was closely correlated ( $r = .7$  to  $.8$ ) with size of testis proper, but not with diameter of tubules or with distance between them; apparently total testicular tissue was the associated variable.

Among testes from 36 inbred boars, mean age at first appearance was 135 days for primary spermatocytes, 155 days for secondary spermatocytes and spermatids and 180 days for spermatozoa. Among testes from 35 crossline boars these mean ages were earlier by 0, 5 and 15 days, respectively. Crosses exceeded parent lines by 28 per cent in body weight, 30 per cent in testis weight, 27 per cent in epididymis weight, 20 per cent in stage of spermatogenesis, 18 per cent in distance between tubules, but only 5 per cent in diameter of tubules. Crosses were intermediate to parent lines in curvilinear regression on body weight, indicating that heterosis in testicular development is an expression of general heterosis in growth. Results from 174 boars at 90 to 175 days of age indicated distinct line differences in both rate and nature of testicular development in relation to body weight, and that these were independent of inbreeding level and were transmitted to crosses of the lines.

There were 216 collections of semen from 23 inbred and 26 non-inbred and crossline boars at 5 to 8 months of age during four seasons; 52 collections were obtained from 7 inbred and 5 non-inbred yearling boars. Age at first successful collection, ranged from 143 to 253 days, averaging about 170 days for 21 non-inbred or crossline and 210 days for 22 inbred boars. Spermatozoa were present in very few (1 in 5) collections at 150 days of age, in two-thirds of those between 164 and 180 days, and in nearly all later collections. A sharp rise in concentration of spermatozoa occurred usually



2 to 3 weeks after first collection and 1 to 2 weeks after first spermatozoa appeared in the semen. Line and inbreeding influences on sexual maturity and sperm production corresponded closely with those on testicular development. Yearling boars showed greater libido, produced nearly twice the volume of semen per collection, and motility of spermatozoa was about 50 per cent greater, compared with boars 7 to 8 months of age. However, there was a rapid rise in concentration and motility from 7 to 9 months of age, and little difference between 9 or 10 months and later ages.

Fertility was determined in 254 matings either by recovery of ova 24 hours after estrus, by return to estrus, or by recovery of embryos 25 days after mating, for 14 inbred and 26 non-inbred boars between 5 and 8 months of age and for 6 inbred and 6 crossline yearling boars. No fertility was obtained in 14 matings adjacent to collections in which there were none or only 1 or 2 thousand spermatozoa per mm<sup>3</sup>. Mean concentration at ages nearest the first fertile mating was 86,500 per mm<sup>3</sup>, but 10 to 20 thousand was usually sufficient for initial fertility. Infertility was rare (3 of 26 boars) in matings after a fertile mating. No association could be demonstrated between fertility and semen characters except aspermia. Frequent service reduced volume and concentration of semen, but libido failed before fertility was impaired.

Among 49 fertile females slaughtered 24 hours postestrus, 9.5 or 81 per cent of the 11.8 corpora counted per sow were represented by ova recovered. Of these 8.9 or 94 per cent showed normal cleavage, indicating fertilization.

The 131 females that were pregnant when slaughtered 25 days after mating averaged 12.5 corpora and 9.2 embryos, of which 1.0 was abnormal or partly resorbed. This indicates about 6 per cent of unfertilized ova, 21 per cent very early complete disappearance of fertile ova and 8 per cent partially resorbed ova, leaving 66 per cent of normal embryos at 25 days.

Only 3 of 40 young boars were regularly infertile; two had normal semen but one was very low in concentration of sperm.

Microfilm copy of complete manuscript of 176 pages, \$2.20. Enlargements 6" x 8", 10¢ per page.

#### DETERIORATION IN FROZEN PORK AS RELATED TO FAT COMPOSITION, STORAGE TEMPERATURE, LENGTH OF STORAGE PERIOD AND PACKAGING TREATMENT

(Publication No 3854)

Arno Zane Palmer, Ph.D.  
University of Missouri, 1952

Deterioration of frozen ground pork, measured chemically and organoleptically, increased as the saturation of the pork fat decreased. The influence of fat saturation on the deterioration of frozen ground

pork was most marked in samples that were either packaged in a waxed paper or stored at 10° F. and widely fluctuating temperatures or both. The keeping quality of pork chops and pork loin roasts stored at 0° F. was not found to be greatly influenced by the saturation of the fat.

Packaging materials differed considerably in their ability to protect against deterioration of frozen pork; differences were greatest at the higher storage temperatures and after prolonged storage.

In ground pork, 0° F. was found to be the most desirable storage temperature of the various temperature treatments. Storage at 10° F. and one or three defrostings followed by 0° F. storage allowed very rapid deterioration in frozen ground pork.

Organoleptic scores on desirability and rancidity of flavor and odor were found to be negatively and significantly correlated with the saturation of the fat of the ground pork; the relationship was pronounced immediately following the induction period.

Correlation coefficients between objective and subjective methods of evaluating the quality of ground pork, though statistically significant in many instances, were too small to be of practical value.

Microfilm copy of complete manuscript of 143 pages, \$1.79. Enlargements 6" x 8", 10¢ per page.

#### A STUDY OF SELECTION FOR FACTORS OF PERFORMANCE IN INBRED LINES OF POLAND CHINA SWINE

(Publication No. 3958)

William Ewert Rempel, Ph.D.  
University of Minnesota, 1952

The performance records of eight inbred lines of Poland China swine were analysed to appraise the effect of selection. All these lines were developed and maintained at the University of Minnesota Experiment Stations in cooperation with the Regional Swine Breeding Laboratory.

The amounts or intensities of selection as expressed by the average annual selection differentials were as follows: (1) number of live pigs farrowed per litter, .90 pig; (2) number of pigs weaned per litter, 1.20 pigs; (3) conformation score, .69 point; (4) feed per hundred pounds of gain, -2.66 pounds; (5a) growth rate as measured by 154 day weight, 15.73 pounds; (5b) growth rate as measured by daily gain from 56 days to 154 days, .13 pound.

Theoretical rates of annual change were computed from the selection differentials of the five factors that were studied, by making due allowance for heritability, generation interval and the effect of inbreeding. Actual rates of change in performance were calculated from the annual means for each factor. The means were weighted by the number of records that determined them.

The theoretical and actual rates of change are in close agreement and are all practically zero. This indicates that performance has been maintained,

and selection has been successful in offsetting the deleterious effects of approximately three to five per cent advance in inbreeding per year.

The flexible systems of selection and inbreeding employed in the development of these lines appear to have contributed as much to the success of the lines as has the amount of selection practiced.

The lines on which this study was based have been subjected to rigid selection for performance from six to fourteen years. This represents a very short length of time in relation to selection studies in smaller animals, and comparably smaller total gains should be expected.

Microfilm copy of complete manuscript of 79 pages, \$1.00. Enlargements 6" x 8", 10¢ per page.

## BACTERIOLOGY AND MICROBIOLOGY

### CHARACTERIZATION OF LEUCOCYTOLYSIS IN EXPERIMENTAL SENSITIZATION TO A GROUP B STREPTOCOCCUS

(Publication No. 3732)

Robert English Chamberlain, Ph.D.  
University of Michigan, 1952

The recognition and investigation of the fundamental reactions which occur following contact of a body cell with a sensitizing agent are of increasing importance to the understanding of the basic mechanisms involved in sensitivity resulting from an infectious process. The leucocytolysis test, originally described by Favour (1947, 1949), offers a quantitative method for *in vitro* studies of this kind. This test involves the lysis of leucocytes in the presence of serum or plasma from a sensitized animal and a filtrate of the sensitizing organism. Up to the present this test has been primarily limited to investigations in tuberculosis. In the work presented here the method has been modified to reduce the clumping tendency of the cells and extended to the study of a state of hypersensitivity resulting from a nonlethal Group B streptococcal infection in guinea pigs, in an attempt to explain the mechanism of the lytic reaction and to characterize some of the substances involved. The skin reaction produced by the streptococcal infection was of the delayed type. The modifications involved the use of larger amounts of the 3 components - normal guinea pig polymorphonuclear leucocytes, serum from sensitized animals, and filtrate of the organism - than employed by Favour, as well as the addition of 0.1 per cent methylene blue. The methylene blue was used as an indicator of viability. By this method it was generally found that 30 to 35 per cent of the cells were lysed, and an additional 35 to 40 per cent were killed but not lysed as indicated by the loss of the ability to reduce methylene blue.

By means of the procedure described above, a

study of the mechanism of the lethal and lytic effects of the serum and filtrate factors was carried out, resulting in these conclusions:

1. The reaction was specific. Filtrates of other closely related organisms did not cause lysis.
2. The extent of the reaction was markedly affected by temperature.
3. The reaction did not occur with normal guinea pig erythrocytes under the same conditions as for leucocytolysis.
4. The active factors from both sensitized serum and products of the sensitizing agent were adsorbed by the leucocyte.
5. This adsorption was followed by death and eventual lysis.

Characterization of fractions obtained from the sensitizing bacteria by use of the formamide extraction method resulted in separation of a fraction active in dilutions of  $1:10^4$ , similar in lytic action to the factor in the filtrate but unrelated to either group specific or type-specific components thus far isolated from Group B streptococci. The activity of this substance in specific *in vitro* leucocytolysis seems to be directly related to the state of sensitivity produced by infection with the whole organism.

Microfilm copy of complete manuscript of 80 pages, \$1.00. Enlargements 6" x 8", 10¢ per page.

### THE PHENOMENA OF PLUGGING IN PAPER MACHINE WET FELTS

(Publication No. 3635)

David Weston French, Ph.D.  
University of Minnesota, 1952

The wet felts of paper making machines may become plugged or occluded by deposits which accumulate on and adhere to the wool fibers. This often occurs before mechanical wear or microbiological deterioration have much affected felt performance, although it may be associated with some aspects of microbiological activity within the felts.

To determine the degree to which various felts were plugged, the following techniques were used:

1. Samples of felt were embedded in plastic, sectioned with a microtome, the sections stained and examined microscopically.
2. The length of time required for a given amount of water to pass through a sample of felt under standardized conditions was determined.
3. The amount of water absorbed by a felt of standard size, and the amount retained after passing the wet sample through a wringer under constant pressure were measured.

A combination of these methods gives more accurate information than any one of them alone. The factors affecting the extent of plugging were studied using these methods.

A number of techniques were devised to determine the nature and composition of the material causing plugging.



1. Plugged felts were extracted with various solvents to obtain resins and similar materials.
2. Felt samples were ashed to determine mineral content.
3. Samples were blendorized in a Waring blender to remove deposits from the fibers. These were subsequently separated and the deposits subjected to various tests to determine their nature.

As a result of these tests it was found that the material causing plugging might consist mainly of resins, filler material, or fragments of wool scales. In many felts, the plugging material was a composite of different substances, with considerable variation in makeup from mill to mill according to the type of pulp processed and the kind of paper produced.

Attempts were made to determine the role that bacteria played in the plugging of felts. The deposits were cultured for the presence of bacteria, and subjected to partition chromatography to detect the by-products of bacterial activity. New felt samples were inoculated with bacteria and increased plugging resulted in comparison with those samples in which bacteria were restricted.

This investigation demonstrated that:

1. Felts may become plugged to the extent that 90 per cent of the area between fibers is filled with deposit material.
2. Materials such as resins and fillers constitute much of this material.
3. Wool scale fragments are also a major constituent of deposits in the felts of many paper mills.
4. Factors other than these materials are responsible for the extent of plugging.
5. One of these factors is bacteria.

Microfilm copy of complete manuscript of 103 pages, \$1.39. Enlargements 6" x 8", 10¢ per page.

#### STUDIES IN PIGMENTATION IN MICROCOCCUS PYOGENES VAR. AUREUS

(Publication No. 3668)

David John Kahler, Ph.D.  
Michigan State College, 1951

A method was devised for determining the amount of pigment produced by Micrococcus pyogenes var. aureus. The organisms were grown in liquid media at 30 C and were shaken during incubation for 24 hours to promote maximum growth. Following the shaking period the cells were separated from the supernatant fluid by centrifugation and washed twice. As the number of organisms was determined photometrically, it was necessary to break up clumps of cells by shaking with glass beads and finally passing the cell mass through cheese cloth. Following the cell count determination, the cells once again were separated from the supernatant fluid by centrifugation and the pigment was extracted from the cell mass with methanol. The extracted pigment was separated from the cell debris, filtered if not absolutely clear

and then the amount of pigment was determined with a Beckman Spectrophotometer. The amount of pigment per cell was calculated by the following formula: Amount of pigment per cell =

$$\frac{\text{Wt. of pigment in 15 ml methanol}}{\text{No. of cells extracted}}$$

Using the above method the effect of various media constituents of pigmentation in M. pyogenes var. aureus were studied. Several workers have reported that organisms can be made to produce pigment by the addition of a particular salt, sugar, vitamin or amino acid and that no pigmentation results when these constituents are absent from the medium. This was not found to be the case with the three test organisms. The degree of pigmentation could be altered when various metabolites were added or withheld but not completely induced or completely suppressed.

In some cases the amount of pigmentation was closely allied with the bacterial population. This was demonstrated when the vitamin supplement was substituted for the yeast extract in a liquid modification of Chapman's 110 medium and when decreasing amount of thiamin and niacin were used in a semisynthetic medium.

The above correlation was also apparent when the amount of pigment was compared in the presence and absence of phosphate salt whereas with the other salts a different situation was presented. Variations in the amount of pigment produced were not accompanied by similar changes in the bacterial populations. The studies made with the various salts demonstrated that the addition of manganese sulfate increased pigmentation by one-third of that obtained with the other salts (ferrous sulfate, magnesium sulfate and sodium chloride) that were tried.

In a similar manner comparison of the various sugars showed that differences in the amount of pigment were not correlated with the bacterial populations. There was less pigment when dextrose served as the carbohydrate sources than with lactose, sucrose or mannite even though the bacterial populations were about the same throughout.

Also a comparison of the filtered and autoclaved mannite and lactose solutions presented similar data as greater pigmentation was obtained with the filtered carbohydrates than was obtained with the autoclaved carbohydrates even though the number of organisms was approximately the same.

The withholding of four amino acids, alanine, tyrosine, glutamic acid and lysine after 11 required amino acids had been added to the medium to obtain growth, had no effect upon pigmentation although there is some question of the validity of these results due to the limited number of organisms which grew.

Microfilm copy of complete manuscript of 81 pages, \$1.00. Enlargements 6" x 8", 10¢ per page.



# AN INVESTIGATION OF A SPECIFIC SEDIMENTATION EFFECT OF CERTAIN SYNTHETIC COMPOUNDS ON PNEUMOCOCCI

(Publication No. 3779)

Frederick Charles Kull, Ph.D.  
University of Michigan, 1952

The purpose of this study was to investigate the mechanism and extent of a unique pneumococcal *in vitro* sedimentation phenomenon and to ascertain its specificity among related and unrelated organisms. A study of chemical compounds structurally similar to the sedimentation-producing quaternary  $\beta$ -formyl- $\beta$ ,  $\beta$ -dimethylethyltrimethyl ammonium bromide (No. 26), was broadened to evaluate the influence of molecular configuration on this phenomenon. The possibility that these sediment-inducing compounds interfered with type 1 pneumococcal antibody activity was investigated by determining the relationship between the sedimentation phenomenon and an apparent blocking of specific immunological reactions by these compounds.

In an investigation of 65 chemically related substances, three quaternary ammonium compounds, No. 26, 33 (choline chloride), and 52 (tetraethylammonium bromide), were found capable of altering the growth characteristics and precipitin reactions of type 1 pneumococcus. This modification of growth, described as a sedimentation phenomenon, was the result of the action of these compounds on the fission mechanism of virulent pneumococcal cells. Bacterial growth in liquid media containing these agents developed in long, unbranched, interwoven chains. This naturally reversible phenomenon was most pronounced in instances where 0.25 to 1% of the compound was contained in pH 7.6 broth having significant amounts of potassium ions. Although the role of age and pH of the pneumococcus culture was important, the type medium used and pH were not factors causing the phenomenon. The influence of bacterial virulence and thus the amount of capsule formation was very important in increasing the incident of pneumococcus sedimentation. A fraction causing a similar sedimentation was found in concentrated filtrates of a group B streptococcus culture.

An examination of 53 laboratory strains showed that the reaction was limited to organisms of the pneumococcus genus. Type I and II pneumococci possessed a greater tendency to sediment in the presence of these compounds than did types III or VII. Avirulent strains of these organisms were not affected by this specific quaternary influence. Cells grown and transferred for several weeks in the presence of these compounds preserved their vitality and virulence. These compounds did not act as surface tension depressants. They did not alter the capsule of the pneumococcus *in vitro* in an observable manner but influenced the glycolytic metabolism of the organisms.

Quantitatively the most effective agent inducing this phenomenon was choline chloride. Evidence suggested that ethanolamine was the responsible principle

in the reaction. The fact that certain pentavalent nitrogen compounds with complex structures initiated partial reactions stressed the importance of chemical configuration. This aspect, as well as the establishment of chemical purity of the employed substances, was ascertained by infrared spectrogram analysis.

The influence of configuration was also observed in quantitative precipitin tests. Tyrosine colorimetric determinations of washed precipitates of a type 1 pneumococcus polysaccharide (S) - anti type 1-S system with Nos. 26, 33, and 52 showed a reduction in precipitated tyrosine which constituted a specific blocking of this antigen-antibody reaction as a function of chemical concentration. Inhibition was not observed when nonsedimenting compounds were employed or when the test was performed in the presence of other immunological systems.

Microfilm copy of complete manuscript of 160 pages, \$2.00. Enlargements 6" x 8", 10¢ per page.

# THE NUTRITION AND FACTORS AFFECTING THE GROWTH OF BACTERIA IN SOLUBLE OILS

(Publication No. 3671)

Hilliard Pivnick, Ph.D.  
Michigan State College, 1952

The bacteriology of soluble oil emulsions was considered from seven different viewpoints: (1) methods of enumerating bacteria; (2) growth of bacteria in soluble oil emulsions; (3) antagonism of non-coliform bacteria towards coliforms in soluble oil emulsions; (4) growth of pathogens in soluble oils; (5) disinfection; (6) nutritional; (7) pure culture studies.

For enumerating bacteria in soluble oil emulsions nutrient agar was satisfactory as a plating medium and M/20 phosphate buffer at pH 7.0 was the best of 11 diluents investigated though it was not completely satisfactory.

Mixed bacteria from soluble oil emulsions grew in fresh emulsions which were made by mixing 13 different soluble soils. Likewise, 13 pure cultures grew well in emulsions made from a single soluble oil. Bacteria from soil, feces, river water, floor sweepings, and air grew in soluble oil emulsions. Bacteria from sputum did not grow.

Coliform bacteria were quickly suppressed by non-coliform bacteria in soluble oil emulsions.

*Micrococcus pyogenes* var. *aureus* was adapted to grow in brain heart infusion broth containing two per cent of soluble oil but alpha and beta hemolytic streptococci were quickly destroyed by contact with small concentrations of soluble oil. *Pseudomonas aeruginosa* grew well in soluble oil emulsions.

Disinfection studies resulted in a simple test for screening possible disinfectants and an apparatus which simulated industrial conditions for testing disinfectants which appeared to be of value. Parachlorometacresol and bis 3, 5, 6 trichloro,

2 hydroxyphenyl methane may have some use in disinfecting soluble oil emulsions.

Increasing the concentration of soluble oil in an emulsion resulted in a faster growth rate and larger bacterial population. Addition of peptone to soluble oil emulsions resulted in larger bacterial populations and foul odors. All soluble oils tested contained some kjeldahl nitrogen and there was an indication that the bacterial population may be proportional to the kjeldahl nitrogen if the oil contains no triethanolamine. Several materials commonly used in compounding soluble oils were investigated for their ability to support growth of pure cultures isolated from soluble oils.

Ninety pure cultures were isolated and investigated. Five genera present were, *Pseudomonas*, *Escherichia*, *Flavobacterium*, *Sarcina* and *Micrococcus* with the *Pseudomonas* being the most abundant. Several hitherto unreported species of *Pseudomonas* are described.

Microfilm copy of complete manuscript of 128 pages, \$1.60. Enlargements 6" x 8", 10¢ per page.

## BIOLOGICAL CHEMISTRY

### THE CHEMICAL FRACTIONATION OF MAMMALIAN SPERMATOZOA INTO LIPOPROTEIN, BASIC PROTEIN AND DESOXYPENTOSE NUCLEIC ACID

(Publication No. 3832)

Richard Duncan Dallam, Ph.D.  
University of Missouri, 1952

Mammalian spermatozoa have been reported by various workers to contain no nucleoprotamine or nucleohistone extractable by the usual means (with water or neutral salt solutions). This has been confirmed in the case of bull, human, dog, boar and ram sperm.

The above mentioned sperm heads can be fractionated into three parts which make up almost all of the total substance of the heads. The lipoprotein is obtained by extracting with a 0.14 M sodium chloride solution adjusted with sodium hydroxide to pH 9.0. The basic protein and the nucleic acid are extract with more strongly alkaline solutions. The lipoprotein precipitates from solution at about pH 5.6, the basic protein in the region of pH 11, and the nucleic acid at about pH 2.0.

The lipoprotein complex has been extracted from bull, human, dog, boar and ram sperm heads and in the case of bull, ram and dog sperm this complex contains 31.9, 25.5 and 23.3 percent lipid respectively which includes phospholipid and cholesterol. The lipoprotein from bull and dog sperm made up 19.5 and 20.8 percent respectively of the total weight of the sperm head. The lipoprotein from human sperm was found to contain only one component

electrophoretically at pH 8.5. Evidence indicates that this lipoprotein is the cell membrane of the sperm head.

A basic protein has been extracted from the above mentioned sperm heads that cannot at present be classified either as histone or protamine. The basic proteins from the sperm of bull, ram, human, dog, and boar have been named "bovin," "ovin," "hominin," "canin," and "suin," respectively. Bovin and canin made up 28.6 and 30.4 percent respectively of the total sperm heads by weight.

The nucleic acid was found to represent 19.5 and 20.8 percent of the total weight of bull and dog sperm heads respectively. It was also found that the nucleic acid fraction was made up entirely of desoxypentose nucleic acid.

Microfilm copy of complete manuscript of 89 pages, \$1.11. Enlargements 6" x 8", 10¢ per page.

### SOME PROBLEMS OF BIOLOGICAL CONJUGATION OF BENZOIC ACID

(Publication No 3756)

Adrian Hainline, Jr., Ph.D.  
University of Michigan, 1952

When benzoic acid is fed to an animal, it is conjugated with glycine to form hippuric acid and with glucuronic acid to form benzoylglucuronide, both of which are excreted in the urine. How the body supplies these two substances, glycine and glucuronic acid, is not well understood. It has been demonstrated previously that in the rabbit the rate of excretion of hippuric acid is increased significantly by the administration of glycine or a readily available precursor of glycine with the benzoic acid. This increase has been considered to be an index of the mobilization of glycine in the organism for the synthesis of hippuric acid. This study was designed to obtain experimental evidence for the availability of several substances for glycine or glucuronic acid formation.

In this investigation, fasted rabbits were given oral administrations of 0.66 gm of benzoic acid (as the sodium salt) per kilo of body weight, alone or with the various compounds studied. Urine samples were usually collected on the sixth and twenty-fourth hours after administration and analyzed for total benzoic, hippuric and glucuronic acids. In one series of experiments, collections of urine were made on the second, fourth, sixth, ninth, twelfth, and twenty-fourth hours.

In the interpretation of the results, the amount of hippuric acid excreted in six hours was considered an index of the rate of its synthesis. The rate of excretion of hippuric acid was increased when glycine or DL-serine was fed with sodium benzoate and the total glucuronic acid excretion was depressed. The effects obtained with DL-serine were not as marked as those obtained with glycine. No significant variations in the excretions of hippuric



or glucuronic acids were obtained with alanine or glucose and benzoate or by three days of fasting.

The increase in urinary hippuric acid and the decreased excretion of glucuronic acid after the administration of DL-serine and benzoate were interpreted as evidence for the rapid conversion of serine to glycine in the rabbit. However, possible glucuronic acid precursors, alanine and glucose, had no significant effect on the excretion of hippuric or glucuronic acid.

Microfilm copy of complete manuscript of 69 pages, \$1.00. Enlargements 6" x 8", 10¢ per page.

#### THE ISOLATION OF GLOBULINS FROM CELL NUCLEI

(Publication No. 3840)

William Richard Kirkham, Ph.D.  
University of Missouri, 1952

The purpose of this study was to confirm the presence and investigate the nature of proteins which are apparently lost from cell nuclei when nuclei are prepared in aqueous media.

Nuclei of calf liver and thymus tissue were isolated by a modification of the Behrens' technique. This consisted of lyophilizing the whole tissue, grinding and isolating the nuclei from the less dense cytoplasm in a mixture of benzene-carbon tetrachloride at various specific gravities. Isolated nuclei were extracted with 0.14 M sodium chloride solution, the solution dialyzed against 0.14 M sodium chloride solution and subjected to electrophoresis. A major component and a few minor components were seen in the patterns. From the thymus and liver nuclear extracts a component precipitated on dialysis against distilled water. Further precipitation occurred by adjusting the pH to 5.0-5.3. This major component was purified by repeated solution and isoelectric precipitation. The major soluble components from thymus and liver nuclei were electrophoretically single substances with isoelectric points of 4.9 (thymus protein) and about 5.6 (liver protein). The two proteins were shown to have solubility properties which indicated the proteins were euglobulins. Nucleic acids were absent from the purified proteins.

It was found that extraction of thymus and liver nuclei as described removed 26 and 42 per cent respectively of the total nuclear mass. This finding confirms suggestions by others that appreciable quantities of material may be lost from nuclei isolated in aqueous media.

Microfilm copy of complete manuscript of 106 pages, \$1.33. Enlargements 6" x 8", 10¢ per page.

#### STUDIES ON THE ENZYMATIC DEAMINATION OF PURINES AND PYRIMIDINES

(Publication No. 3826)

Jacob Kream, Ph.D.  
Columbia University, 1952

Micromethods are described for the study of certain enzymes involved in purine and pyrimidine metabolism. Adenase of *E. coli*, guanase and 8-azaguanase from rabbit liver, and cytosine deaminase from *E. coli* and bakers' yeast have been studied. The micro enzyme methods used are based on the methods developed in this laboratory for the separation and quantitative estimation of purines and pyrimidines by paper partition chromatography and ultraviolet spectroscopy. Minute amounts of enzyme or substrate could be used by direct mixing of enzyme and substrate on paper followed by incubation in a moist environment. The preparation of cell free extracts of certain of these enzymes are described.

Cytosine deaminase from yeast was partially purified by ammonium sulfate precipitation of the active material from crude cell free extracts. This enzyme preparation was stable for long periods of time when stored in the dry state at low temperatures. The kinetics of the enzymatic reaction were studied by similar methods as previously described. The pH was found at pH 6.9, the temperature optimum lay between 34° and 37.5°. The preparations contained neither guanase nor adenase.

Conclusions as to the structural specificity of the enzyme could be drawn from the fact that it did not deaminate 2-methoxy cytosine, 2-thiol cytosine, isocytosine, cytidine, cytidylic acid, 2, 6-diamino pyrimidine, 4-hydroxy cytosine, 4-amino cytosine, isoguanine, and 5-amino uracil. 5-Methyl cytosine, however, was deaminated to thymine. Isocytosine was shown to act as an inhibitor of cytosine deaminase.

By use of partially purified yeast cytosine deaminase and an analytical method developed for the separation and estimation of micro amounts of 5-methyl cytosine, it was demonstrated that the sole base in a new nucleotide isolated by Dr. W. E. Cohn was in fact 5-methyl cytosine.

Microfilm copy of complete manuscript of 122 pages, \$1.53. Enlargements 6" x 8", 10¢ per page.

#### THE BIOCHEMISTRY OF DORMANCY IN THE MYXOMYCETE PHYSARUM POLYCEPHALUM

(Publication No. 3861)

Andrew Jackson Sullivan, Jr., Ph.D.  
University of Missouri, 1952

We have examined existing gross culture methods for slime molds as they applied to the two species Fuligo septica and Physarum polycephalum and found them inadequate for culturing large masses of the organism for biochemical analyses. Further,



we have examined methods which claimed pure culture of myxomycetes, particularly applying the methods to the culture of *Physarum polycephalum*. We have found them completely inadequate for the culture of this species. In the absence of suitable culture methods we have made observations and conducted experiments designed to lead to the development of new media for *Physarum*. Several yeast media, a supplemented folic acid assay medium, and several oat media have proved inadequate, but we were able to obtain masses of plasmodia of our species in gross culture, such as we could obtain by no other method, by a new type oatmeal medium.

It has been shown that plasmodia cultured on the new oatmeal medium, and sclerotia produced from them, are sufficiently free of contaminants that analyses can be successfully duplicated in numbers which lend statistical significance to their results.

Aspects of culture of microorganisms are discussed.

In investigating the bound water content of dormant and active material we have found that the bound water content of active material exceeds that of dormant. It is believed that this difference simply reflects the higher content of certain colloidal constituents observed in active material. Thus, there also occurs in active material (1) a higher content of unidentified long-chain polysaccharides which we have determined as citric acid hydrolyzable polysaccharides, (2) a higher glycogen content, and (3) a mucoprotein constituent which is not present in dormant material.

Determinations of nitrogen levels in active and dormant material reveal an increase of about 13 per cent during sclerotization. When results of other analyses are expressed on a unit nitrogen basis, however, they retain their qualitative difference.

It has been demonstrated that major changes occur in the carbohydrate metabolism during sclerotization. These changes are evidenced primarily by (1) a decrease in the content of water-insoluble long chain polysaccharides (2) a decrease in glycogen content, and (3) a decrease in reducing sugars. The changes in carbohydrate metabolism are concurrent with increased synthesis of lipids as evidenced by a much higher content of lipids in dormant material. A conversion of carbohydrates into lipids is suggested.

Although protein fractions were isolated from both active and dormant material and examined we were unable to obtain adequate data on the fractions to indicate what changes, if any, occurred during sclerotization. However, it has been shown by several lines of evidence, that a mucoprotein is present in active material, but absent from, or present only in very low quantity in dormant material.

In examining material for evidences of changes in phosphorus metabolism it has been found that total phosphorus increases about 25 per cent during sclerotization. This, we have shown to be established independently of fluctuation in dry matter during sclerotization. When the phosphorus is fractionated,

the increased phosphorus is clearly evidenced in the acid soluble fraction, and the phosphoprotein fraction. The phospholipid fraction is quite low in *Physarum*, but it is tentatively offered that this fraction increases during sclerotization. Evidence is presented which indicates that both pentose nucleic acid and desoxypentose nucleic acid levels are higher in dormant than in active material. Qualitative evidence is presented which indicates that the increase in the organic fractions mentioned above occurs at least partially at the expense of inorganic phosphorus in the organism since the level of inorganic phosphorus drops during the sclerotization process.

Microfilm copy of complete manuscript of 183 pages, \$2.29. Enlargements 6" x 8", 10¢ per page.

#### INFLUENCE OF SOME NUTRITIONAL FACTORS ON THE ASH CONTENT, BREAKING STRESS, AND ELASTICITY OF RAT BONES

(Publication No. 3963)

John Patrick Towey, Ph. D.  
University of Minnesota, 1952

##### 1. The Breaking Stress and Elasticity of Rat Bones.

A Method was developed for judging the quality of rat bone based on the breaking strength, breaking stress, and modulus of elasticity of the femur, selected as a representative bone. These determinations were made with a specially fitted Tate-Emery machine.

##### 2. The Effect of Subcutaneous Injections of Sesame Oil on Rat Bones.

There was no significant difference in ash content, dry fatfree weight, percent ash, breaking strength, breaking stress or elastic modulus of the femurs from rats injected with sesame oil compared with femurs from rats injected with isotonic saline.

##### 3. The Analysis of the Synthetic Diet for Vitamin D Content.

When the raw materials of diet, that were found Vitamin D free by the USP biological assay procedure, were further tested by feeding to just-weaned rats, an altered synthetic diet containing a rachitogenic Ca/P ratio of 5.09 and a rachitogenic content of calcium (1.023 per cent) and phosphorus (0.203 per cent), rickets did not develop. This indicates that the critical amounts of calcium and phosphorus, as well as the Ca/P ratios for producing rickets should be redetermined.

##### 4. The Effect of Vitamin D on the Growth of the Skeleton of the Adult Rat.

The ash contents of humeri from rats receiving oral supplements were significantly higher than the ash contents of humeri from rats receiving injected supplements. The increased handling,

necessary for subcutaneous injections hindered the growth of the humeri.

#### 5. The Effect of Various Calcium Salts on the Regeneration of the Osteoporotic Skeleton.

The skeleton of adult rats became osteoporotic when the animals were maintained on a protein ( $< 0.02\%$ N) and calcium ( $< 0.003\%$ ) free diet with the decrease of humeri ash content paralleling the decrease in body weight.

Adult rats weighing approximately 310 grams were held on a calcium-protein-vitamin D free diet until an average weight of 145 grams was reached.

The depleted animals were divided into two groups and pair fed adequate diets, with one group receiving a supplement of vitamin A and the other a supplement of vitamin A and D. Each group was further subdivided into six smaller groups and in the diet of each, calcium was present as one or the other of the following salts: acid phosphate, chloride, carbonate, sulphate, citrate, lactate and phosphate. The animals were sacrificed at 260 grams.

In the group receiving only a supplement of vitamin A, there were no significant differences in the ash contents or the ash percent of the femurs except that those fed tricalcium phosphate were significantly lower. The breaking strength and breaking stress of the femurs of rats fed calcium acid phosphate, calcium chloride and calcium citrate were identical but exceeded the values for rats fed calcium sulfate, calcium lactate and tricalcium phosphate. There was no significant difference in the modulus of elasticity for the various groups.

The femurs of rats from the group receiving supplements of vitamin A and vitamin D, showed a significantly greater ash content, dry fat-free weight, breaking strength, breaking stress and ash per cent, and a significantly lower modulus of elasticity, when compared with the femurs from the group receiving only the supplement of vitamin A.

The femurs of rats fed calcium citrate showed a significantly greater ash content, dry fat-free weight, breaking strength and breaking stress, when compared to the femurs of other rats. Rats fed calcium sulfate showed a significantly lower ash content and dry fat-free femur weight. There was no significant difference in the modulus of elasticity between the subgroups.

Microfilm copy of complete manuscript of 153 pages, \$1.91. Enlargements 6" x 8", 10¢ per page.

#### THE AMINO ACID COMPOSITION AND NITROGEN METABOLISM OF TETRAHYMENA GELEII

(Publication No. 3823)

Chung Wu, Ph.D.  
University of Michigan, 1952

Although the literature on the amino acid composition of plant microorganisms is abundant, the

corresponding data for animal microorganisms are still lacking. Therefore, it was decided to determine these data and also to learn whether the amino acid composition of a protozoan was affected by the medium composition and by adaptation to a synthetic medium. Furthermore, certain phases of nitrogen metabolism, e.g., the degree of utilization of the essential amino acids, the end products of nitrogen metabolism, etc. were of interest in relation to a study of this organism. For the purposes of investigation, two types of *Tetrahymena geleii* E were employed. One was maintained on a peptone medium (P type) and the other adapted to a synthetic medium containing the eleven essential amino acids (S type). The cells of P type were grown on both peptone and synthetic media to get cultures P-P and P-S respectively. The cells of S type were grown on the synthetic medium to obtain the culture S-S. The cells from each culture were harvested, dried and pulverized. The filtrates from cultures P-S and S-S were preserved for analysis.

Hydrolysates of the three cell preparations and the two cell-free culture filtrates were analyzed for eighteen different amino acids by microbiological technique and for total nucleic acid by ultra-violet spectrophotometry. The culture filtrates were analyzed additionally for ammonia, urea, uric acid, allantoin, creatine and creatinine. The cells of an actively growing culture of P-P were homogenized for the determination of urease and arginase activity.

When the amino acid composition of the three cell preparations was compared, the amino acid content was found to decrease from preparations P-P to P-S and to S-S. However, no qualitative difference was noted. In other words, there was no amino acid which was present in one preparation but absent from another. The most pronounced quantitative difference was in the tryptophan content which was 200 per cent higher in preparation P-P than in preparation S-S. This clearly demonstrates an effect of medium composition and adaptation upon the quantitative amino acid composition of a protozoan. Also, the culture S-S exhibited some diminished capacity of protein synthesis, i.e., low protein nitrogen, and yet it possessed high trichloroacetic acid extractable nitrogen (non-protein) and a high total nucleic acid nitrogen. All three cell preparations were high in "free" amino acid nitrogen (i.e., trichloroacetic acid extractable). This latter property seems to be characteristic of microorganisms.

The analyses of cell-free culture filtrates indicate that the essential amino acids were utilized to various degrees by the organism. Thus, as much as 90 per cent of L-phenylalanine but as little as 4 per cent of L-histidine in the medium was utilized. The culture filtrates were also analyzed for non-essential amino acids. In the order of their abundance, they appear to be glutamic acid, glycine, alanine, aspartic acid, tyrosine and cystine. No proline could be detected and the cystine was found only in very low concentration.



Ammonia appears to be the main, if not the only, non-amino acid nitrogenous end product. No urea, uric acid or allantoin could be found. Both creatine and creatinine were present in very small amounts.

On the basis of the nitrogenous products which were determined, it was possible to construct a nitrogen balance sheet. The total nitrogen content of nitrogenous products in the cells and filtrate could account for more than 95 per cent of the total nitrogen content of the original medium.

Both arginase and urease have been shown to be absent. These results suggest that the Krebs-Henseleit cycle does not operate in this organism.

Microfilm copy of complete manuscript of 82 pages, \$1.03. Enlargements 6" x 8", 10¢ per page.

## BOTANY

### ABSORPTION OF RADIOCALCIUM BY POTATO TUBER SLICES

(Publication No. 3845)

William Gordon Long, Ph.D.  
University of Missouri, 1952

The present day concepts of ion absorption postulate (1) an adsorption of the ion at the outer protoplasmic surface and (2) the subsequent transfer of the adsorbed ion inward toward the vacuole. Several surface adsorption constituents have been proposed, i.e. aromatic alcohols, proteins and nucleotides. Similarly, several mechanisms have been considered for the inward transport, involving proteins, organic acids, and the cytochrome oxidase system. If these concepts are true, it should be possible by allowing potato tuber slices to absorb radiocalcium followed by extraction of the tissues and fractionation of the extracts to recover certain fractions which accumulate the radioactive indicator. If accumulation occurs in any of the fractions, this may indicate that the fraction is involved somewhere in the process.

Uniform slices of "Idaho Russet" potatoes were allowed to absorb radiocalcium for specified time periods from solutions of known concentrations. The rate of absorption was modified by varying temperature and pH, and by comparing prewashed and unwashed slices. The 2°C. temperature virtually eliminates accumulation of ions. The treated tissues were freeze-dried, ground, extracted with buffer solutions and fractionated by one of two methods. In the first eleven experiments, fractionation was by precipitation and filtration, in the last three, centrifugation (using a high speed vacuum type angle centrifuge) and precipitation. The fractions were freeze-dried, weighed and wet ashed by the nitricperchloric acid method. The ash was taken up in three normal hydrochloric acid and dried in planchets under a

heat lamp. The resulting residues were counted with a G.M. scaler, the data corrected, and the necessary calculations made.

The results of the experiments show that the uptake of radiocalcium increased with increasing concentration up to a certain molarity; above this value, the relation is lost. The uptake at 25°C. was two to three times that at 2°C. Similarly, two to four times more absorption occurred in twenty-four hours than in ten minutes. Optimum pH is necessary to obtain rapid absorption. Activity of the fractions usually increases about fifty per cent when buffered at pH 6 instead of unbuffered at the 3.0 to 4.8 range.

The results from the assay of the various fractions show several facts: (1) There is a loss of the absorbed ions to distilled water during dialysis (ten to ninety per cent). (2) The centrifugally separated fractions are higher in purity but the comparable fractions show similar trends as shown by the following relations: (1) The fractions show lower activities, generally, if not prewashed or if allowed to absorb at 2°C. (2) Initial increases (one hour absorption) over the activity of the potato powder (per mg.) occurred in the microsomes, nucleoprotein (cytoplasmic), acid insoluble albumin, and mitochondria. The results from both methods compare favorably in some respects despite the dialysis loss and lower purity of the fractions by the precipitation-filtration fractionation. (3) If the prewashed tissues are allowed to absorb for the same length of time, there is about a thirty per cent increase in potato powder activity. The only increases over the activity per milligram of the potato powder were in the nucleoproteins and slight increases in the mitochondria and microsomes. The nuclear nucleoprotein activity was about double that of the cytoplasmic fraction. (4) If the prewashed tissues were allowed to absorb for twenty-four hours, the nucleoproteins were highest followed closely by the greatly increased activity of the mitochondria and microsomes. In all other cases, the activity of the fractions was equal to or less than the activity per milligram of the potato powder.

It is clearly demonstrated by the data that the four fractions (cytoplasmic nucleoprotein, nuclear nucleoprotein, mitochondria and microsomes) probably are involved in cation transport. The nature of the substance responsible for surface adsorption is not clear, but the nucleoprotein (cytoplasmic fraction) shows a tremendous amount of activity. However, the microsomes, acid-insoluble albumin, and mitochondria also show accumulation. Shorter absorption periods at 2°C. will have to be utilized to get more data on this aspect.

Microfilm copy of complete manuscript of 58 pages, \$1.00. Enlargements 6" x 8", 10¢ per page.



# A STUDY OF THE TETRAZOLIUM REACTION IN PLANT TISSUES

(Publication No. 3856)

Lorin W. Roberts, Ph.D.  
University of Missouri, 1952

Aqueous solutions of several oxidation-reduction indicators (monotetrazolium salts, ditetrazolium salts, potassium tellurite, and resazurin) were reduced by certain plant tissues to colored, insoluble, and non-diffusible compounds. Reduction of the indicators in stem sections of *Acer Negundo* and *Acer saccharum* was shown to be correlated with the position of lateral and terminal buds in the vicinity of the nodes. The following regions of the stem were sites of strong reducing activity with the monotetrazolium indicators: branch and leaf traces, cambium, xylem ray cells, the medullary sheath, and, in some cases, the cortex. The ditetrazolium salts were partially reduced to the monoformazan in the branch and leaf traces, cambium, and phloem. Resazurin was reduced to resorufin (by the branch and leaf traces, cambium, xylem ray cells, and cortex) and to dihydroresorufin (by the medullary sheath). The dihydroresorufin was oxidized back to resorufin in the medullary sheath after several hours. The possible role of enzymes in the reduction of indicators by *Acer* spp. stem tissues has been investigated. Stem sections were treated with maleic hydrazide. No appreciable inhibition of reduction was observed in these sections, although this compound has been reported to inhibit certain dehydrogenases. The reported effect of auxin on ascorbic oxidase activity suggested that the latter enzyme might have a possible role in reduction of these indicators. However, no increased reduction of the indicators was observed by the addition of buffered ascorbic acid solutions of varying concentrations.

Studies were made with 1-(4-chloromercuri-phenylazo)-naphthol-2 which has a high specificity for sulfhydryl groups. A red color indicates the histochemical localization of sulfhydryl groups which have combined with the indicator. Tetrarch roots of *Phaseolus vulgaris*, tested with the sulfhydryl reagent, showed that active sulfhydryl groups were present in the same tissues that gave the tetrazolium reaction. Embryos of *Phaseolus vulgaris*, tested with the sulfhydryl reagent, were stained uniformly throughout the plumule, hypocotyl, and radicle. The majority of the redox indicators were also reduced uniformly throughout these tissues. Sulfhydryl groups in stem sections of *Acer* spp. were confined to the following tissues: branch and leaf traces, cambium, xylem ray cells, medullary sheath, and cortex. The redox indicators, with the exception of the ditetrazolium salts, were reduced in these same tissues. Experiments were conducted to test the effect of sulfhydryl inhibitors on the reduction of the redox indicators. The following inhibitors were used in a study of embryos of *Zea Mays*: iodoacetic acid, 2, 4-dinitrophenol, hydroxylamine sulfate, coumarin, ethyl carbamate,

and phenyl mercuric chloride. Preliminary experiments, which are not conclusive, have indicated a slight inhibition in the reduction of the tetrazolium indicators by the use of these sulfhydryl inhibitors in an aqueous medium. The best indirect evidence for the correlation of sulfhydryl groups and the tetrazolium reaction comes from *in vitro* experiments. The redox indicators were reduced, *in vitro*, by cysteine, reduced glutathione, and BAL (2, 3-dimercaptopropanol-1). There was no reduction of the indicators, *in vitro*, by cystine and methionine. However, if cystine was first treated with potassium cyanide, which converts cystine to cysteine, reduction of the indicators occurred. Cyanide has a reducing effect on sulfhydryl-containing compounds. It was observed that tissues first exposed to cyanide and then to the redox indicators showed a faster and more intense color change than control sections. These experiments have demonstrated the ability of active sulfhydryl groups, *in vitro*, to reduce the redox indicators, and have suggested a possible role of sulfhydryl groups in the reduction of indicators in living tissues.

Microfilm copy of complete manuscript of 139 pages, \$1.74. Enlargements 6" x 8", 10¢ per page.

# ENZYME STUDIES ON DORMANT AND ACTIVE POTATO TUBERS

(Publication No. 3862)

Glen William Todd, Ph.D.  
University of Missouri, 1952

While investigations of the underlying causes of the rest period and dormancy of potato tubers have been numerous, the mechanisms of the phenomena are still unknown. It seems possible that these changes might be governed by changes in some of the respiratory enzymes or of metals contained in the prosthetic groups of these enzymes. Therefore, in this study the problem was attacked by fractionating the cellular protein components and observing the enzyme and metal changes within these protein fractions.

Potato tubers were obtained soon after harvest and were stored at temperatures of 2° C. and 25° C. Each month tubers of the 2° C. lot were subjected to a temperature of 25° C. for 10 days. Tubers from all three treatments were subjected to protein extraction and fractionation. These fractions were assayed for the enzymes catalase, peroxidase, tyrosinase, and cytochrome oxidase, and analyzed for their iron, copper, and manganese content.

The spectrographic analyses did not reveal any striking changes occurring within the protein fractions. The amount of iron ranged from 0 to 900 ug/g of protein; copper from 15 to 100 ug/g of protein; manganese from 0.5 to 11 ug/g of protein.

Less than 1 per cent of the total protein bound iron could be accounted for by the enzymes catalase

and peroxidase. More than half of the protein bound copper could be accounted for by the enzyme tyrosinase.

There was a marked increase in catalase activity of tubers stored at 2° C. and a decrease in activity of tubers stored at 25° C. There was a decrease in catalase activity when tubers stored continuously at 2° C. were placed at 25° C. for 10 days.

Tubers stored continuously at 2° C. showed a lower peroxidase activity in the acid soluble albumin fraction than the 10 day 25° C. tubers. These changes of peroxidase activity in this fraction were not found in the respective homogenates, indicating that measurement of only the latter may not disclose changes taking place in the various fractions. The peroxidase activity of the globulin and albumin fractions showed marked changes, while the sum of the activities of the two was constant. This indicates a shift of enzyme from one protein fraction to another.

There was a marked decrease in tyrosinase activity with storage at either 2° or 25° C. with the larger decline in the latter. This enzyme was the only one tested that showed a direct relationship with the rest period at both temperatures. The hypothesis is suggested that during the rest period, respiration occurs primarily through the tyrosinase system and during growth primarily through the cytochrome oxidase system.

Microfilm copy of complete manuscript of 97 pages, \$1.21. Enlargements 6" x 8", 10¢ per page.

## DAIRY HUSBANDRY

### THE FAT-GLOBULE MEMBRANE OF HOMOGENIZED MILK AND SOME RELATED FACTORS

(Publication No. 3667)

Jay Robert Brunner, Ph.D.  
Michigan State College, 1952

The occurrence of high viscosity and chalky flavor in milk homogenized at temperatures lower than the normal processing temperatures (80° F.) has been reported by Moore and Trout (1947). Certain other abnormalities in the characteristics of milk have been associated with the homogenization process. Weinstein and Trout (1951) stated that enhanced susceptibility of homogenized milk to the solar-activated flavor was due, in part, to the increase in the surface area of the fat and suggested that the active ingredient involved might have been a protein adsorbed on the fat globule.

Experiments were conducted with milks of various compositions (a) to study the effect of variation in the homogenization procedure on the development of high viscosities in homogenized milk; (b) to determine the amounts of solidified fat in

globular fat at temperatures which are conducive to the development of high viscosities; and (c) to report on the isolation and preliminary electrophoretic-and-compositional characterization of the fat-membrane proteins of nonhomogenized and homogenized milk.

Milk containing five per cent or more fat, low homogenization temperatures (80° to 70° F.) and high, single-stage homogenization pressures (2,500 pounds per square inch or higher) are conditions which contribute to the clustering of fat globules and to the development of a high viscosity in homogenized milk. The detrimental effects of these processing conditions on the viscosity of homogenized milk were reduced or completely eliminated by double-stage homogenization or by maintaining the temperature of homogenization above 100° F.

At homogenization temperatures (70° to 90° F.) conducive to the formation of an extensive, apparent fat-globule-cluster structure and a high viscosity, the milk fat was partially solidified. The extent of fat solidification in milk homogenized immediately after pasteurization varied from approximately 0.5 to 2.0 per cent and from 7.0 to 18.0 per cent in pasteurized milk which had been stored at 45° F. for 20 hours prior to homogenization.

The standard homogenization pressure (2,500 pounds) had little effect on the nitrogen content of various fractions of milk proteins. However, an abnormally high pressure (4,000 pounds) caused a reduction in the heat-coagulable and proteose-peptone nitrogen and an increase in the casein and nonprotein nitrogen.

The distribution of solids-not-fat, nitrogen, calcium, phosphorus and ash between the skim milk, cream, washed cream and washed-cream sera of nonhomogenized and homogenized milk showed a greater adsorption or protein per gram of fat in homogenized milk than there was in nonhomogenized milk.

Fat-membrane proteins were isolated from washed cream, butter-milk-like sera by extracting the lipid materials by an ethanol-ether washing technique, after which the protein residue was dispersed in distilled water and lyophilized to an anhydrous powder.

The lyophilized membrane-proteins contained about 13.5 per cent nitrogen.

The electrophoretic patterns obtained for the fat-membrane proteins in various buffer systems, ranging from pH 1.5 to 10.8, showed distinct differences in the characteristics of the protein components of the two membrane-protein preparations, indicating that the fat-membrane proteins associated with nonhomogenized milk fat are different from the fat-membrane protein associated with homogenized milk fat.

No definite conclusions can be formed from the results of the microbiological analyses for amino acids concerning any differences in the composition of the fat-membrane proteins of nonhomogenized and homogenized milk. Some minor differences in amino acid concentrations do exist, especially in the case of lysine which was present in a higher



concentration in the homogenized milk membrane-proteins than in the nonhomogenized milk membrane-proteins. Both of the membrane-protein preparations differed in their amino acid compositions from any of the recognized milk protein fractions.

Moore, A. V., and Trout, G. M., "High viscosity and progressive thickening of homogenized milk," Mich. Agr. Expt. Sta. Quart. (1947), Bul. 29 (3): 177-187.

Weinstein, B. R., and Trout, G. M., "The solar-activated flavor of homogenized milk. III. Effect of deaeration, surface area of fat globules and relation of the Kreis test," Jour. Dairy Sci., (1951) 34: 565-569.

Microfilm copy of complete manuscript of 251 pages, \$3.15. Enlargements 6" x 8", 10¢ per page.

#### A STUDY OF SOME CAUSATIVE MECHANISMS IN STREPTOCOCCUS AGALACTIAE INFECTIONS OF THE BOVINE MAMMARY GLAND

(Publication No. 3850)

Charles Preston Merilan, Ph. D.  
University of Missouri, 1952

Microscopic examinations of streptococcal mastitic milk and broth cultures of Streptococcus agalactiae indicated that the morphological form of Streptococcus agalactiae as found in the udder apparently differs from that found in many laboratory cultures. Casein-acetate-lactose broth was found to favor the maintenance of morphological characteristics which were similar to those of the organisms in unincubated streptococcal mastitic milk. Contaminant bacterial cell-forms in the complex constituents of some media interfered with morphological observations of cultures grown on those particular media. "Motility" was exhibited by Streptococcus agalactiae cells. In three instances, cell multiplication was observed following a brief period of rapid, progressive movement by pairs of diplococci.

The effect of Streptococcus agalactiae filtrates upon the *in vitro* anaerobic glycolysis of bovine mammary tissue slices was studied by means of the Warburg technique using sodium acetate as the metabolic substrate. A total of 135 determinations were made on tissue from seven cows. The Lancefield group B organisms were isolated from acute cases of streptococcal mastitis and grown in a casein-acetate-lactose broth. Eighteen-hour cultures were rendered sterile by means of Selas No. 03 porcelain filters and the comparative effect of these filtrates and uninoculated medium determined manometrically. Short-chain Streptococcus agalactiae filtrates caused a marked decrease in the rate of anaerobic glycolysis compared to the slight inhibitory effect of long-chain Streptococcus agalactiae filtrates and uninoculated medium.

One hundred and twenty-two intramammary infusions of Streptococcus agalactiae filtrates and uninoculated casein-acetate-lactose broth were made into individual quarters of eight cows. Infusions of short-chain Streptococcus agalactiae filtrates produced hardness and swelling of the infused quarters within one to two hours, followed by rectal temperature increases of three to five degrees Fahrenheit reaching a peak six to nine hours after infusion. The rectal temperatures returned to approximately normal at twelve to fourteen hours although production of physically abnormal milk persisted for two to three days. Subsequent daily infusions of the filtrate in the same quarter resulted in continued production of abnormal milk; however, the response of the quarter in the form of swelling gradually decreased with each consecutive infusion. Temperature response to continued infusions varied from no effect to a gradual decline in temperature of three to five degrees Fahrenheit. Subsequent infusions of filtrate in different quarters of the same cow caused marked physical and temperature responses similar to those induced by the initial infusion. Infusions of the uninoculated medium and long-chain Streptococcus agalactiae filtrates produced only minor symptoms of irritation in the infused quarters although the milk obtained at the first post-infusion milking period was physically abnormal.

Microfilm copy of complete manuscript of 74 pages, \$1.00. Enlargements 6" x 8", 10¢ per page.

#### A SURVEY OF THE UTILIZATION OF C<sup>14</sup> CARBOXYL LABELED ACETATE BY THE PERFUSED BOVINE MAMMARY GLAND

(Publication No. 3955)

Lewellyn Stanley Mix, Ph. D.  
University of Minnesota, 1952

Three perfusions with isolated bovine mammary glands were performed during 1951. Chlorazol fast pink was used as the blood anticoagulant. The right half of each gland was premilked using Pitocin. One millicurie of carboxyl labelled C<sup>14</sup> acetate in 50 mls. of physiological saline was added to each arterial blood after premilking the gland. Ten mls. of 40 per cent dextrose was added at half hour intervals. The duration of the three perfusions was 4 hours, 5 hours and 50 minutes, and 5 hours and 15 minutes respectively. All three glands were milked twice after the activity was added. A total of 785 mls. of milk was obtained from Experiment 1, 2990 mls. of milk from Experiment 2, and 395 mls. of milk from Experiment 3.

The ether extract and the glycogen from the gland tissue were labeled in all three experiments, but no activity was present in any fraction of the milk in Experiment 1. In Experiments 2 and 3, milk cholesterol was labeled as well as the volatile soluble, volatile insoluble and non-volatile fatty



acids. The specific activity of the fatty acid fractions decreased with increased chain length.

In addition, the following milk constituents were found to be radioactive: casein, non-casein protein, non-protein nitrogen fraction, lactose, urea, citric acid and free  $\text{CO}_2$ .

Venous blood samples contained radioactive  $\text{CO}_2$ . The specific activity of the blood  $\text{CO}_2$  counted as  $\text{BaCO}_3$  decreased rapidly after the first hour indicating that acetate is readily used as a source of energy.

On the basis of the evidence cited indicating the incorporation of  $\text{C}^{14}$  into many constituents of the mammary gland and milk, it would appear that acetate is readily utilizable by the mammary gland probably through its entrance into the tricarboxylic acid cycle. The continuous absorption of acetate from the rumen, its uptake in measureable quantities, and its utilization for milk synthesis by the mammary gland necessitates a reevaluation of its importance as a metabolite.

Microfilm copy of complete manuscript of 93 pages, \$1.16. Enlargements 6" x 8", 10¢ per page.

#### UNIFORMITY TRIALS AND EFFECTS OF VARYING PLANES OF NUTRITION ON PERFORMANCE OF MONOZYGOTIC BULLS

(Publication No. 3956)

Howard Halfdan Olson, Ph.D.  
University of Minnesota, 1952

There are very few published data pertaining to the effects of nutrition on the reproductive capacity of the bull. In an attempt to gain some knowledge of the effects of nutrition on the fertility of the bull, two sets of monozygotic triplet bulls were used in a nutritional trial. Two sets of monozygotic twins and one set of monozygotic triplet bulls were used as controls to determine the variability of performance within sets of monozygotic bulls under uniform conditions. This is the first time extensive use has been made of monozygotic twin and triplet bulls for the study of the factors influencing semen production.

In both the uniformity and nutritional trials the performance of the bulls was measured by growth, general appearance, behavior patterns and the quantity and quality of semen which they produced. The quantity and quality of all semen samples were measured by volume, concentration, total number of spermatozoa per ejaculate, initial motility, methylene blue reduction time, abnormal counts and percentage of live spermatozoa.

Within the sets of monozygotic bulls subjected to a uniform environment, the performance of each member was similar to his mate or mates as measured by growth, general appearance, behavior patterns and the quantity and quality of semen produced. Members of the set of monozygotic triplet bulls used in this study were similar to

their mates in poor libido and lack of cooperation at the time of semen collection.

Plan of feeding for the nutritional trials was that one member of two sets of monozygotic triplet bulls were placed respectively on 70 per cent, 100 per cent and 130 per cent levels of total digestible nutrient intake based on Morrison's standards for feeding bulls. One set was placed on these rations at eight months of age and continued to 36 months of age. The other set was on this study from 27 months to 64 months of age of which this thesis includes the last 27 months. Measurements of quantity and quality of semen generally favored the bulls fed 100 per cent and 130 per cent of the normal ration. During the first part of the trial, the well fed bulls exhibited the greatest libido; however, toward the end of the experiment more difficulty was had in collecting semen from these bulls as compared to the bulls fed the below normal rations. There are strong indications from the nutritional trial that increased feeding stimulates earlier sexual development as well as enhancing the quantity and quality of semen.

The data collected in this experiment are presented both in tabular and graphic forms. All of the data were subjected to an analysis of variance.

Microfilm copy of complete manuscript of 198 pages, \$2.48. Enlargements 6" x 8", 10¢ per page.

#### THE ROLE OF PLASMA CELLS IN THE PRODUCTION OF GLOBULINS WITHIN THE MAMMARY GLAND AND TIME STUDIES ON ANTIBODY RESPONSE FROM EXPERIMENTALLY INDUCED INFLAMMATION OF THE UDDER

(Publication No. 3089)

Robert Milo Porter, Ph.D.  
University of Minnesota, 1951

Plasmacytosis in the udder during colostrum secretion and after cessation of milking.

The concept that plasmacytes play a role in the production of immune globulins was brought forth first in the medical field when it was noticed that the plasmacytes were present in numerous conditions of inflammation. Later work, correlating the development of plasmacytes to the production of antibodies, has given the plasmacyte a major role in the defense mechanism of the body.

The udder is an excellent organ to study the concept that the plasmacyte has a role in the formation of lactoglobulin, which reaches a very high concentration in colostrum. This concept presupposes that synchronous plasmacytosis occurs in the udder during the prepartum regeneration of the secretory tissue then disappears postpartum.

The series of biopsies taken on cow 854 before and after parturition demonstrates that the presence of plasmacytes in the tissue coincided with the formation of colostrum. The plasmacyte appears early during the regeneration of the secretory

tissue, reach their maximum concentration at about the time of parturition and then disappear postpartum as the milk returns to normal. The group of cells on the imprints, which are similar to lymphocytes in appearance, are worthy of note as the lymphocyte is one of the basic cells from which the plasmacyte arises.

The appearance of plasma cells in the right half of the udder a few days after cessation of milking, while no plasmacytes appeared in the left half of the udder, on which milking was continued, would seem to indicate that the plasmacyte also has a role in inflammatory conditions of the udder. Relation of the antibody titer and time of response in the blood and the milk when antigens are experimentally introduced.

There have been numerous observations on the relative antibody content of the milk and the blood, but the workers have differed in their opinions as to whether the antibodies were formed in the reticulo endothelial system or whether it was possible for antibodies to be produced locally in the udder. The marked differences in the inflammatory and titer responses in cases of mastitis indicates that hypersensitivity, antigen strength, dosage, frequency of exposure, bacteriostatic property of the milk, the anamnestic response, and the Schwartzman phenomenon may all have a role in the titer and antibody response. The permeability of the endothelium and epithelium, the invasion of leucocytes and macrophages, and the development of plasmacytes are other important factors to be considered.

The inflammatory and agglutinin titer responses to the injection of the antigen depends upon the previous history of the tissues. There was no correlation between the degree of the inflammatory response and the antibody titer development. This can best be explained by the Schwartzman phenomenon.

If this explanation is used, it must be assumed that the antigen does not pass into the control quarters in a high enough concentration to sensitize the tissue as there is no Schwartzman phenomenon in these quarters from the second injection. Conversely then the agglutinin titer appearing in the control quarters would have to be due mainly to the antibodies passing from the blood stream into the milk. This view is hard to justify in some cases where the agglutinin titer in the control quarters is as high as it is in the injected quarter or the blood.

In view of the foregoing findings it would seem reasonable to assume that the exacerbations which occur in cases of mastitis may be explained on the basis of the comparative levels of antibodies and antigens. When the concentration of antibodies diminishes, the suppressing effect on the growth of the organisms is apparently decreased, this permitting their rapid multiplication. This results in a shocking dose of antigen which is followed by a rapid rise in the antibody concentration which suppresses the growth of the organism.

Microfilm copy of complete manuscript of 108 pages, \$1.35. Enlargements 6" x 8", 10¢ per page.

## A HISTOLOGICAL AND HISTOCHEMICAL STUDY OF THE BOVINE OVIDUCTS, UTERUS AND PLACENTA

(Publication No. 3863)

Howard James Weeth, Ph.D.  
University of Missouri, 1952

An attempt has been made to provide a more complete basis from which to interpret reproductive phenomena in the cow. Oviducts, uteri, and placentas removed at slaughter from reproductively normal cows in known stages of the estrous cycle and gestation were studied histologically. In addition, the tissues were examined histochemically for type of connective tissue, alkaline phosphatase, lipid, and glycogen.

The oviducts are active during the follicular phase of the cycle, as evidenced by the high level of alkaline phosphatase activity and the concentrated cytoplasmic basophilia. Indications of regression are seen during the luteal phase. The mucosal epithelium shows increased pseudostratification, goblet-like cells, and extruding nuclei during early diestrus. Glycogen and small amounts of lipid accumulate during the luteal phase. The oviducts seen during gestation resemble the oviducts of diestrus.

Changes which occur in the uterus during the estrous cycle are not marked. Progestational proliferation and glandular activity continue throughout diestrus as shown by intense alkaline phosphatase activity in the epithelium at this time. Very little epithelial lipid or glycogen is seen during the luteal phase. The uterine surface shows localized desquamation during estrus or metestrus, and blood becomes trapped in the stratum compactum during this regressive stage. Should conception occur, the entire uterus continues to hypertrophy. The uterine glands continue secretion, with some decrease in activity in late gestation.

The uterine part of the placentome is an outgrowth from the stratum compactum of the caruncle. It forms crypts which surround the villi of the fetal cotyledon. A low syncytium of undetermined origin covers the septa of the caruncular crypts everywhere except on their distal ends. This syncytium contains a lipid, and it forms a complete alkaline phosphatase barrier between maternal and fetal bloods.

The trophoblast of the villi is an irregular syncytium on which are characteristic giant cells. The giant cells react heavily for alkaline phosphatase and glycoprotein. The trophoblast between the bases of the villi is predominantly irregular, tall columnar cells. These cells absorb histotroph from the space which separates them from the distal ends of the caruncular septa. Red blood corpuscles absorbed by the columnar trophoblast give rise to yellow-brown, lipoprotein pigment deposits.

The columnar trophoblast of the intercotyledonary chorion resembles that seen in the placentome; however, acetone-soluble lipid granules were definitely identified here.



Two postpartum uteri were observed. At 8 days postpartum, the uterus contained an amorphous mass of degenerating placentomes. Regression was not completed in the 25 day postpartum uterus.

Microfilm copy of complete manuscript of 98 pages, \$1.23. Enlargements 6" x 8", 10¢ per page.

## FORESTRY AND CONSERVATION

### COOPERATIVE AND FEDERAL SUSTAINED-YIELD FOREST UNITS - A PROBLEM IN RESOURCE MANAGEMENT

(Publication No. 3708)

Thomas Cooper Adams, Ph.D.  
University of Michigan, 1952

This is a study of forest policy and its application under the Act of August 28, 1937 (50 Stat. 874) and the Sustained Yield Forest Management Act of 1944 (58 Stat. 132). These acts authorize establishment of sustained-yield units, composed either entirely of federal timberland or of federal timberland managed cooperatively with private timberland, for sustained-yield forest management and for stabilization of dependent communities and local industries, through allocation of public timber to them for manufacture. One cooperative unit and five wholly federal units have been established. Widespread opposition to the principle of cooperative units has prevented further establishment of such units. The federal units have gained some approval, yet share much of the same opposition. This raises a question of the fundamental soundness of the legislation, and presents a problem of either devising means to win acceptance of the program, to modify it so as to overcome legitimate objections, or to find alternative ways of organizing and managing the forest for optimum beneficial use.

The method of this study has been one primarily of logical analysis and interpretation. The history, application, and philosophy of the sustained-yield legislation are examined. Arguments for and against the concept of these units are reviewed, and new evidence is presented in which the general body of economic doctrine is explored as it has developed with respect to economic organization in general. Selected foreign experience in forest allocation is reviewed. In the course of the study brief visits were made to most of the areas where sustained-yield units have been proposed or established. On-the-ground observation has been supplemented by informal interviews with persons active in support of or in opposition to these units, or engaged in their administration.

Results indicate that while this legislation was soundly conceived to encourage private forestry and community stability, it underestimated important social and political aspects. Traditional attitudes and beliefs have played an important

part in explaining its popular disfavor. Moreover, a growing segment of the forest industries is now able to operate its forests on a stable ownership basis, and many private forests are already receiving a satisfactory form of management under present arrangements.

The author's conclusion is that although cooperative units could simplify management on mixed ownerships, recognize social values on private land, and tap important forces of business enterprise eager to demonstrate its abilities in resource management, the program must be rejected for lack of adequate criteria on which to choose potential cooperators, and for lack of ability to avoid discrimination in an industry often highly dependent on public timber for its support. Community stability and incentive for plant investment can be encouraged by proper management of the public forests and by the favorable atmosphere to private forestry generated by maintenance of a high level of economic activity and effective demand in the national economy. The wholly federal units have been ably administered, but need a longer record of experience before a valid appraisal of them can be made.

Microfilm copy of complete manuscript of 221 pages, \$2.76. Enlargements 6" x 8", 10¢ per page.

### FACTORS INFLUENCING THE INCIDENCE OF HYPOXYLON CANKER OF ASPEN

(Publication No. 3936)

Ralph Leo Anderson, Ph.D.  
University of Minnesota, 1952

The canker disease of aspen caused by *Hypoxyylon pruinaum* is, at present, the most important cause of aspen mortality. This study was undertaken to obtain information on the epidemiology and control of the disease. The approach used was to study environmental factors, host vigor and stand conditions in relation to incidence of the disease.

Two hundred and eleven one-tenth acre plots were established in the Lake States Region. Data were obtained on tree size and vigor, and all cankers. Other tree species were tallied to complete the stand tally. Stand age and site index were determined and data obtained on a variety of environmental factors pertaining to soil and water relations, history of the site and associated vegetation.

Most analyses were made by plot comparisons, i.e., incidence of infection was calculated for each plot, the plots grouped in categories and average incidence obtained for each category.

Two methods of determining incidence of infection were used in most analyses, one based on living trees with killing cankers and the other on living and dead standing trees of the upper crown classes with killing cankers. Incidence was based on killing cankers since non-killing cankers tend to accumulate more in some stands than others.

Each factor was analyzed several times, using a



variety of plot groupings, in order to avoid distorted results due to extreme variation of other known variables.

It was found that 4.2 per cent of the living trees were infected with killing cankers. Incidence varied from 1.8 per cent in the extreme northern part of Minnesota to 4.8 to 6.1 per cent elsewhere in the region.

No correlation was found between tree vigor or site index and incidence of infection. It is believed that a given incidence of infection causes greater damage, however, on poor sites.

Incidence of infection is reduced in old stands.

A strong correlation was found between low stand density and high incidence of infection. A possible causal relationship was indicated, i.e., low stand density may expose or predispose trees to infection. It was found that cankers tend to face certain directions more than others and that canker distribution on the tree stems varies with stand density. These results tend to substantiate the theory that relative exposure of the bark area may be an important factor. Wounding, such as by hail, or an environment favorable to spore dissemination and germination, etc., may account for the above correlations.

Other species, especially an understory of other hardwoods, is associated with high incidence of infection. Some evidence indicates lower incidence in stands containing conifers.

The analyses of soil and water relations, site history and successional trends did not present any convincing correlations. There is some evidence that incidence is lower when surface drainage is good, internal drainage poor, general moisture relations good, virgin forest type not climax conifers, and the site not frequently or severely burned.

Slightly lower incidence was found in second generation stands, indicating that there may be some natural selection for resistance.

The results indicate that it must be established for certain whether exposure of the bark area increases incidence of infection before other environmental factors can be evaluated successfully.

The importance of local sources of inoculum, the principal wounding agents, and factors influencing wound susceptibility, spore production and effective dissemination should be studied.

It is recommended that high stand density be maintained, and breaks or openings in stands kept to a minimum. Poor sites, low stand density, and an understory of other hardwoods apparently should be avoided in selecting stands to be managed as aspen type.

Microfilm copy of complete manuscript of 110 pages, \$1.38. Enlargements 6" x 8", 10¢ per page

## THE SILVICS AND SILVICULTURAL TREATMENT OF BLACK CHERRY IN NORTHWESTERN PENNSYLVANIA

(Publication No. 3769)

Bertram Husch, Ph.D.  
University of Michigan, 1952

Black cherry is a valuable American timber tree that reaches its best development in the Allegheny Plateau Region. Within this geographic province, the species is most important in a limited area of northwestern Pennsylvania, termed the High Plateaus Region, when it leads all others in percentage of the total timber volume.

Evidence points to the fact that black cherry has a more important role in the cutover forests that now exist than it had in the old-growth stands in the past. Disturbance of the old-growth forests by cutting and fire increased the percentage of this intolerant species. With present stands composed of a high percentage of black cherry, attention has been directed towards ways of maintaining and even increasing the amount of cherry in the stands that will follow cutting of the existing forests. In addition to increasing the amount of cherry, it is recognized that this reproduction must develop into high-quality trees to be valuable.

One of the problems investigated in this thesis was to determine the most promising regenerative method to produce high-quality, vigorous black cherry reproduction. The investigations were based on the premise that the behavior of the species under past treatments would serve as a guide to evaluating various methods of regeneration that could be used in the future. The results of these studies showed that the best reproduction occurred in stands clearcut in strips or cut to low diameter limits in patches. These results suggest that cuttings of this type will prove successful as methods of regenerating black cherry.

Regeneration is not the only important factor in the management of black cherry. Following regeneration it is necessary to carry out certain silvicultural measures to establish this reproduction and assure the development of a valuable stand. Early stump desproutings and weedings are necessary to improve the composition and character of the developing stand. Thinnings should start as soon as commercially feasible, usually when the stand reaches about 45 years of age. Early thinnings are desirable not only to stimulate growth and improve the stand but for the sake of returns to offset the early cultural costs.

The effects of tree size, grade, and product on the returns from cutting were analyzed. The differences in conversion returns for different-sized trees containing wood content of varying quality when put into different products were shown. For the specific costs and returns used, it was shown that the marginal tree is about 12 inches d.b.h. An analysis was also made to show the average rate of value increase for trees of different sizes. The principal purpose of these calculations is to serve

as a guide for deciding which trees should be cut in a thinning or partial cutting.

Analyses were carried out to determine what rotation could be successfully used to manage black cherry. The final choice was a result of weighing all the influencing factors and deciding upon a satisfactory compromise. After carrying out computations to determine the technical rotation, the rotation of highest mean annual increment, highest soil expectation values, and highest forest rent values, a rotation of from 70 to 85 years was decided upon as most satisfactory.

A possible application of the silvicultural and management recommendations was worked out for a hypothetical forest, representative of the area. A regulatory period was proposed for this forest to effect a better distribution of age classes and satisfy the aim of management. The manner in which regeneration cuttings, improvement cuttings, and thinnings could be applied under this plan of management was shown.

In brief the results of this investigation show that the successful management of black cherry is keyed to several requirements. First of all, black cherry must be regenerated by some clear-cutting or diameter limit cutting scheme. Secondly, the successful establishment of regeneration following cutting is dependent on intensive silvicultural measures. Thirdly, for maximum volume and value returns, established stands should be periodically thinned and a rotation in the vicinity of 80 years adopted. In addition the proper cutting of trees in thinnings based on financial maturity and the wise selection of markets will increase returns and bring intensive management into the realm of practicability.

Microfilm copy of complete manuscript of 335 pages, \$4.19. Enlargements 6" x 8", 10¢ per page.

#### LEAD POISONING IN MIGRATORY WATERFOWL, WITH SPECIAL REFERENCE TO THE MALLARD *Anas platyrhynchos* L.

(Publication No. 3774)

James Schuyler Jordan, Ph.D.  
University of Michigan, 1952

The purposes of this study are (1) to evaluate losses from lead poisoning in migratory waterfowl that ingest commercial shot pellets which have been expended over the feeding areas of waterfowl by hunters, and (2) to attempt to reduce these losses by developing and introducing a nontoxic shot.

The study was divided into two phases: (1) Field investigations, and (2) pen experiments. The frequency of occurrence of various numbers of shot ingested by waterfowl was determined through fluoroscopy of live-trapped ducks and fluoroscopy of gizzards from samples of waterfowl bagged by hunters throughout the United States. Wild mallard

drakes, *Anas platyrhynchos platyrhynchos* L., were trapped, banded, dosed with shot pellets, and released alternately with equal numbers of undosed control birds. Several species of waterfowl were held in captivity, and the effects of given doses of commercial and non-commercial shot pellets were observed.

It was shown that the supply of available shot is largely limited to the quantity expended over the feeding areas by hunters each season. Fluoroscopy of more than 18,000 gizzards revealed that 6.57 per cent of the ducks in 12 leading species had ingested one or more shot pellets; 65 per cent of these had taken only one. Variations in the incidence of shot among species were attributed to differences in methods of feeding and in types of habitat preferred. Band returns from dosed mallards indicated that migration was retarded, and lead-poisoned birds were more vulnerable to the gun. The ingestion of not more than one shot pellet did not appear to materially lower the numbers of drake mallards from one year to the next.

As shown by results of pen experiments, lead from ingested shot appeared to have a direct, damaging effect on smooth muscles of the digestive tract, and lead-poisoned waterfowl failed to consume adequate amounts of food. Lead-induced starvation appeared to be the direct cause of death. The size and hardness of food items, and the amounts consumed had an important influence on the effect of ingested lead. Food intake varied with sex and age, and the effect of lead varied accordingly. Rates of mortality increased with the shot dose, but symptoms and survival periods did not change. Some severely affected birds apparently recovered from lead poisoning following elimination of shot or renewal of appetite. Shot alloys containing lead showed no promise of alleviating lead poisoning in waterfowl. Iron shot was nontoxic when fed to mallards. This alloy is not now on the market commercially, but may be available to waterfowl hunters in the near future.

Until iron shot becomes obtainable, losses from poisoning may be reduced by (1) increasing the amounts of certain natural waterfowl food plant resources, (2) dispersing waterfowl from known focal areas of lead poisoning, and (3) exercising greater care in shooting and thereby reducing the amount of shot expended on the feeding grounds of waterfowl.

Microfilm copy of complete manuscript of 155 pages, \$1.94. Enlargements 6" x 8", 10¢ per page.

#### THE SAGE GROUSE IN THE UPPER GREEN RIVER BASIN OF WYOMING

(Publication No. 3788)

Robert Lansing Patterson, Ph. D.  
University of Michigan, 1952

Sage grouse are the most characteristic upland game birds of the sagebrush prairie. Once as



abundant as the ubiquitous sagebrush, they were so reduced in numbers that by the middle 1930's fears were expressed in conservation circles that the species was on the verge of extinction. Within recent years they have been restored in substantial numbers throughout large areas of western United States, notwithstanding the destruction of large amounts of original habitat.

The present study represents the first comprehensive account of the decline and subsequent restoration of the sage grouse. Year-round field investigations were conducted for three years on an intimately known area of land in the upper Green River Basin of Wyoming – a region long famous as the center of sage grouse abundance in the West. Emphasis was placed on land-use activities as related to grouse abundance, distribution, productivity, and management. Population data were obtained through intensive censuses of birds on their breeding and wintering grounds. Ecological and natural history aspects of the species received detailed study. The history and status of grouse populations in the western states and Canadian provinces supplement the data collected in Wyoming.

The original range of the sage grouse conformed to the distribution of the sagebrush (*Artemisia tridentata* and closely related types). This area included the semiarid plains of the intermountain and northwestern states and the southern border of the three southwestern Canadian provinces. Sage grouse are solely dependent on sagebrush for the requisites of food and shelter during the winter months; at other seasons, it furnishes the bulk of their habitat requirements.

The pattern of decline in sage grouse numbers has been little different from that exhibited by other game animals in the West. Exploitation of sagebrush habitat as well as poorly planned protective measures have been basic causes of decrease in grouse numbers. These decimating factors have exerted influences upon sage grouse mainly through overgrazing, early shooting seasons, high bag limits, and the elimination of sagebrush.

In primitive times grouse attained their greatest abundance on the fertile sage lands of intermontane valleys and mountain foothills. Maximum utilization of surface water supplies for irrigation, as well as for other domestic and industrial purposes, has been an outgrowth of the settlement of sage grouse range; such use of water has restricted grouse distribution.

Grouse exhibit distinct seasonal migrations between breeding and wintering ranges, complicating the task of management. States having the smallest human population densities contain the largest acreages of sagebrush and the highest populations of sage grouse.

The nature of sage grouse breeding activities, as well as the birds' extreme mobility, has been of value in restoring depleted grouse populations and in maintaining remnant populations adjacent to areas of destroyed habitat.

There is a striking correlation between the intensity of livestock use and game abundance on the

western range. At the period of maximum livestock use (1900-1920) sage grouse, antelope, and associated game species were at their lowest point in numbers. Within the past fifteen years, these animals have responded to improved management of range resources and once again have attained positions of prominence in the fauna of the West.

The species is in no danger of immediate extinction. Continuation of present range policies will go far toward assuring the permanence of sage grouse populations.

Microfilm copy of complete manuscript of 474 pages, \$5.93. Enlargements 6" x 8", 10¢ per page.

## GENETICS

### INHERITANCE OF REACTION TO LEAF RUST, *PUCCINIA RUBIGOVERA TRITICI* (ERIKS.) CARLETON, AND OF CERTAIN OTHER CHARACTERS IN A WHEAT CROSS

(Publication No. 3652)

Lorenzo Martinez M., Ph. D.  
University of Minnesota, 1952

The primary purpose of the present study was to determine the mode of inheritance of leaf rust reaction in a cross of Thatcher x (Premier x Bobin-Gaza-Bobin) N.S.No. II-39-2. The inheritance of stem rust reaction and of awnedness was also studied.

Thatcher is a spring wheat variety susceptible to a large number of leaf rust races in both seedling and mature plant stages. The II-39-2 parent is highly resistant in the seedling stage to a number of leaf rust races and moderately resistant in the mature plant stage to a number of leaf rust races in the field.

The parents and their  $F_1$ ,  $F_2$  and  $F_3$  progenies were used to study mature plant reaction to a collection of leaf rust races in the field during the summer of 1950. The same material was used in the study of mature plant reaction to a collection of stem rust races and in the study of inheritance of awnedness.

Seedlings of the parents,  $F_2$  and  $F_3$  plants and  $F_4$  bulked lines from Thatcher x II-39-2 were used in the study of inheritance of reaction to leaf rust races 1, 2, 3, 5, 15, 28, 58, 126, 128a and to a collection of 18 leaf rust races bulked.

The inheritance of mature plant reaction to a collection of leaf rust races in the field was explainable as due to the action of three genetic factor pairs independently inherited, any factor in the dominant condition causing susceptibility.

The seedling reaction to leaf rust races 1, 2, 5, 15, 28 and 128a was found to be determined by 6 different genetic factors; one factor for each race.



Susceptibility was dominant. The reactions to these races were highly but not completely associated, suggesting linkage of these 6 genes. Assuming linkage, a linkage map was set up which fits closely the observed recombination values. Designating the genes by the race number, the gene order was 1-128a-15-2-28-5 with recombination values or map distances in successive regions of 0.9+0.7, 1.0+0.9, 1.0+0.9, 0.9+0.7 and 1.8+1.1, respectively. Although the data agreed well with the hypothesis more genetic and cytological data are needed to prove the correctness of the hypothesis of linked genes, since there may be other possible explanations.

The reaction to each of the leaf rust races 3, 58, 126 and to a collection of 18 leaf rust races bulked, was found to be determined by two genetic factors. The reaction to races 3 and 58 was shown to be of the 15s:1R two factor pair interaction type. The reaction to race 126 is probably of the 13S:3R two factor interaction type. No plant counts were made in the study of reaction to the collection of 18 leaf rust races bulked and, therefore, it was not possible to determine the type of two factor pair interaction responsible for the reaction to the group of races.

Association studies of seedling reactions to individual leaf rust races revealed that a minimum of 8, and probably 12, genetic factors control the seedling reaction to races 1, 2, 3, 5, 15, 28, 58, 126 and 128 a in the material studied. If the reactions to races 1, 2, 5, 15, 28 and 128a were explained as due to one single gene the total number of genes would be 3 and 7, respectively.

Association was found between seedling and six-leaf stage reactions of  $F_4$  plants to a collection of 18 leaf rust races bulked. However, only 63 per cent of the 304  $F_4$  plants tested gave the same reaction in the seedling and six-leaf stages. Thirty-two per cent of these plants showed more resistance in the six-leaf stage than in the seedling stage, while five per cent showed less resistance in the six-leaf stage than in the seedling stage.

One major genetic factor appeared to control the mature plant reaction to a number of stem rust races in the field. The susceptibility of II-39-2 was dominant over the moderate resistance of Thatcher.

One single factor pair was found to control the inheritance of awnedness. The awnletted condition of Thatcher was dominant over the bearded condition of II-39-2.

There was slight evidence of association between seedling reaction to race 3 of leaf rust and awnedness.

The relatively large number of genetic factors segregating in this cross accounts for the difficulty in recovering lines equal in resistance to the original resistant II-39-2 parent.

Microfilm copy of complete manuscript of 71 pages, \$1.00. Enlargements 6" x 8", 10¢ per page.

## HORTICULTURE

### A STUDY OF THE INHERITANCE OF SEVERAL CHARACTERS IN THE CUCUMBER, *Cucumis sativus* L.

(Publication No. 3659)

Victor Bernarr Youngner, Ph. D.  
University of Minnesota, 1952

A study was made of the inheritance of sex form, locule number, immature fruit color, ovary protrusion, and spine color in crosses between the cucumber variety Lemon and the varieties Orient, Deltus, and Plant Introduction 127583. A study was also made of association of these characters and the linkage intensities of the characters showing linkage.

Sex form was found to be governed by a single factor pair, Momo. The monoecious form was completely dominant over the andromonoecious.

A single factor pair, L1, differentiated the parents in locule number. The three-loculed form was completely dominant over the five-loculed form. Occasional four-loculed fruits were found on some plants of the three-or five-loculed forms, but no plants were found in which all fruits were four-loculed.

Immature fruit color was conditioned by two factors,  $Gr_1$   $gr_1$   $Ww$ . The dominant condition of both factors produced a dark green fruit color. The dominant  $Gr_1$  and recessive  $w$  factors produced a light green color while the recessive  $gr_1$  factor caused a yellow-green color regardless of the nature of the  $W$  factor.

Non-protruding ovary versus protruding could be explained by a single factor difference, Pp. The non-protruding condition was completely dominant over the protruding condition. Much variation was found in the extent of the ovary protrusion on individual plants.

The parents were found to differ by a single factor pair, Bb, for spine color. Black spines were dominant over white spines.

Sex form and ovary protrusion appeared in this study to be completely associated either by complete linkage or as expressions of the same factor. Linkage may be so close that crossover did not occur in the populations grown. Monoecious sex form was associated with non-protruding ovary and the andromonoecious sex form with protruding ovary.

Association studies showed independent inheritance of spine color and sex form, spine color and locule number, spine color and immature fruit color, sex form and immature fruit color, and locule number and immature fruit color.

Association studies suggested the presence of linkage between sex form and locule number. A recombination value of 32.63+1.41 per cent was obtained from all the data of the three crosses.

Microfilm copy of complete manuscript of 53 pages, \$1.00. Enlargements 6" x 8", 10¢ per page.

## MEDICINE AND SURGERY

A STUDY OF THE PATHOGENESIS OF  
CORONARY SCLEROSIS: AN ANALYSIS OF ITS  
DEVELOPMENT WITH RELATION TO AGE,  
SEX, AND OTHER FACTORS

(Publication No. 3950)

Paul Hallam Lober, Ph. D.  
University of Minnesota, 1952

The relationships of many factors in the development of coronary sclerosis are still poorly understood. The study of postmortem material is one of the most useful means of investigation of this process. An attempt has been made in this study to determine whether coronary sclerosis is a process which is slowly progressive throughout life, or whether it advances by steps or stages. The age at which the sex difference in the severity of coronary sclerosis begins was also investigated.

This study consisted of the thorough examination of 536 hearts removed at autopsy from individuals of both sexes and of all ages from birth to 89 years. These were collected without regard for cause of death. The hearts were examined by careful gross dissection, and microscopic sections were made of the most severely involved areas of the three main coronary arterial branches. The arteries were graded microscopically on the basis of infiltration of the intimal layer, degeneration of the elastic lamina, relative area of the lumen, relative thickness of the intima, and outside diameter of the vessel. The grading was done by one individual. The autopsy reports of these cases were examined for cause of death, symptoms or signs of heart disease, evidence of diabetes or malignant neoplastic disease, age, sex, body weight, height, and weight of the heart.

The results of this survey showed a gradually progressive increase in severity of the coronary sclerosis beginning in infancy. There was a leveling off at the 8th decade, which was believed to be due to survival of a few individuals with remarkable hearts. The progressive increase was found with each of the criteria used. The area of the lumen decreased from 62 per cent of the area of the artery in the newborn, to 21 per cent in the 9th decade males. Intimal thickness ranged from 12 per cent of the artery wall in female newborns, to 81 per cent in 9th decade males.

Males were found to have more severe coronary sclerosis than females in every decade. The sex difference in intimal thickness was mathematically significant in the age group of 1 - 12 months, and the difference in area of lumen was significant in group 1 - 9 years of age. Once established, the sex difference remained fairly constant until senility, when there was some decrease.

A control group consisting of those individuals who died of external means or of acute infectious diseases was used for comparison. These showed degrees of coronary disease similar to the whole series.

Those individuals with hypertrophied hearts not due to other cause were regarded as showing evidence of hypertension. These had greatly increased degrees of coronary sclerosis. A group of 18 diabetics also showed increased severity, although the number was too small for statistical analysis.

Those individuals dying with a malignant neoplastic disease were found to have less severe coronary sclerosis than the group as a whole. This difference was mathematically significant. The explanation is not clear, although a terminal period of severe dietary restriction may be important.

Persons having symptoms or death from coronary disease were found to have very severe degrees of sclerosis, generally of all three arterial branches.

The data presented relate to a group of individuals and not to the disease process in a single person. However, the progress of the disease in an individual may reasonably be assumed to be similar to the pattern of the group.

Microfilm copy of complete manuscript of 101 pages, \$1.26. Enlargements 6" x 8", 10¢ per page.

## IODINE IN THE BLOOD AND URINE OF MAN

(Publication No. 3957)

Joseph Edward Rall, Ph. D.  
University of Minnesota, 1952

The metabolism of radioiodine in man has been investigated previously with respect to the metabolism of inorganic iodide. It has been the purpose of this study to investigate the form of radioiodine in the blood and urine after it has become incorporated into organic compounds. The low concentration of radioiodine in these fluids necessitated certain modifications of existing methods for its estimation. A digestion distillation procedure was evolved which was of sufficient sensitivity to permit the measurement of very small quantities of radioiodine. Methods used for the separation of radioiodine in the thyroxine-like, diiodotyrosine-like and iodide-like fractions were adaptations of classic chemical procedures utilizing solubility differences in butanol, zinc hydroxide and sodium hydroxide. The thyroxine-like fraction was taken to be that radioactivity which was precipitable with the Somogyi reagents, extractable with n-butanol and not reextractable with 5N NaOH and 5 per cent  $\text{Na}_2\text{CO}_3$ . The diiodotyrosine-like fraction was the sum of the radioactivity extractable from n-butanol with alkali and the radioactivity not precipitated by Somogyi reagents and also not precipitated by silver sulfate. Control experiments demonstrated from 70 to 85 per cent recovery of added thyroxine and diiodotyrosine. Iodide was recovered to the extent of 99 per cent. It was found that in euthyroid and hyperthyroid patients 72 hours after the ingestion of radio-iodine most of the serum



radioiodine was present as a thyroxine-like moiety (from 67 to 100 per cent). In patients with myxedema only small amounts of labeled thyroxine were found in the serum. Small amounts of labeled thyroxine (0.3 per cent to 10 per cent of the total urinary radioiodine and variable amounts of labeled diiodotyrosine (3 per cent to 68 per cent) were found in the urine of euthyroid and hyperthyroid patients after the administration of radioiodine. The radioiodine in the urine was further investigated by means of paper chromatography and an area of radioactivity was demonstrated in the locus where thyroxine was found to appear in control chromatograms. The urinary radioactivity was also studied by crystallization procedures. Non-labeled thyroxine was added to a suitable urine extract and recrystallized 6 times. A constant specific activity was found after the first 2 crystallizations. These data suggest that thyroxine was present in the urine of the patients studied.

Microfilm copy of complete manuscript of 116 pages, \$1.45. Enlargements 6" x 8", 10¢ per page.

## PHYSIOLOGY

### STRESS INDUCED BY MUSCULAR EXERTION AS INDICATED BY CHANGES IN LEUCOCYTE CONCENTRATION AND URINARY KETOSTEROIDS: A STUDY OF CERTAIN PHYSIOLOGICAL CHANGES INDUCED BY EXERCISE

(Publication No. 3620)

Nathan Lavenda, Ph.D.  
New York University, 1952

#### Problem and Significance of the Study

The purpose of the study was to determine whether muscular activity of a standard intensity could stimulate the adrenals to react, and whether there are significant differences in the cortical adrenal reactions between normal individuals who exercise frequently in some strenuous physical activity and normal individuals who do not.

In this study the investigator also explored the possibility that there are individuals who pass the usual medical examination but yet are either incapable of engaging in strenuous activity or suffer severe physical disturbances by so doing, showing the presence of certain deficiencies hitherto not considered in the selection of candidates for sports. If muscular activity were shown to be a stressful stimulus in man, the possible consequences resulting from inadequate cortical adrenal responses to sports would be explored.

#### Procedure

A group of males in the late twenties and early thirties in age were subjected to the same routine

procedures, and were grouped according to the following criteria:

1. Those medically fit subjects who exercised frequently (at least once a week in some specified strenuous sport).

2. Those medically fit subjects who either exercised infrequently or not at all.

3. Those who demonstrated fatigue complaints and could not complete the exercises satisfactorily.

Blood and urine samples were taken prior to exercise and compared with samples taken after exercise. The criteria used to evaluate the cortical adrenal response were: a significant increase in urinary ketosteroids, a significant drop in circulating eosinophils and lymphocytes. In those cases failing to complete satisfactorily the exercise series, stimulation of the adrenals with epinephrine hydrochloride was attempted to determine whether a faulty cortical adrenal mechanism was present.

Since emotions play a strong role in the initiation of the cortical adrenal response it was considered important to estimate the extent of these factors in this study. Consequently some healthy subjects were given the entire procedures with the omission of exercise. Any changes effected in these individuals could be attributed to factors extraneous to exercise, principally of psychological origin. The results of the analysis of blood and urine were treated statistically using group analysis techniques.

#### Conclusions

1. Exercise of the intensity used in this study induces changes indicative of a cortical adrenal response in eosinophils and lymphocytes in the peripheral circulation.

2. Determination of urinary ketosteroids as a criterion does not appear to be practicable since the variation is large.

3. Of the three indicators used the eosinophil count is the most sensitive for the determination of the cortical adrenal response.

4. Exercise habits do not affect the response to exercise of moderate intensity.

5. The demonstration of emotional tension does not result in cortical adrenal reactions different from those reactions elicited from subjects who not demonstrate such tension.

6. Those subjects who did not complete the exercise satisfactorily failed to effect a cortical adrenal response. The failure of epinephrine to effect a response indicates a faulty pituitary-adrenal mechanism. It is inferred from this that at least a percentage of those complaining of chronic fatigue have a faulty pituitary-adrenal mechanism.

Microfilm copy of complete manuscript of 144 pages, \$1.80. Enlargements 6" x 8", 10¢ per page.



## PLANT PATHOLOGY

## STUDIES ON VIRUSES OF CEREAL GRAINS

(Publication No. 3937)

Robert Emmet Atkinson, Ph.D.  
University of Missouri, 1952

Studies were made of 5 virus diseases of cereal grains: western wheat mosaic, barnyard grass mosaic; stunt of wheat; green mosaic of wheat; and barley false stripe. Western wheat mosaic was studied most extensively.

Western wheat mosaic is sometimes destructively epidemic in the hard red winter wheat area. The symptoms are mottling and streaking of the very young leaves, followed by yellowing and decreased vigor, stunting, and sometimes premature death. Severe infection may delay heading and reduce the number and weight of kernels more than 50 per cent in both spring and winter wheats.

The virus may be latent in winter wheat during the winter. Plants inoculated in early autumn developed symptoms which later disappeared but reappeared in the spring or when the plants were placed in the greenhouse.

Wheat heavily infected with western wheat mosaic often has symptoms of dryland footrot, a disease attributed to various causes. Lesions of *Helminthosporium sativum* P. K. and B. are commonly found at the crown of such plants. In repeated inoculations, combinations of the virus and the fungus caused no greater damage than that caused by the virus alone. The severity of the disease was equal on plants growing in steamed and non-steamed field soil. Apparently the virus can produce symptoms that resemble that caused by footrot fungi. On the other hand, oat varieties susceptible to Victoria blight inoculated with the virus were injured more severely by *H. victoriae* M. and M. than were virus-free plants.

The virus is easily transmitted by the carborundum-rub method. The greenbug, *Toxoptera graminum* Rond. transmitted the virus to 43.7 per cent of 273 plants exposed and the apple-grain aphid, *Rhopalosiphum prunifoliae* (Fitch), transmitted it to 38.2 per cent of 322 plants. In repeated tests there was no evidence for seed or soil transmission.

Hosts include wheat, oats, barley, corn and proso millet. All common hard-red winter wheats tested and 25 varieties of spring wheats were susceptible. *Triticum durum* Desf., *T. turgidum* L., and *T. dicoccum* Shubl. were very susceptible.

The incubation period in the greenhouse is from 4 to 14 days, but it may extend through the dormant period of winter wheat in the field.

The virus of barnyard grass mosaic is like that of western wheat mosaic and may be the same.

Stunt-virus, isolated from winter wheat in Minnesota, infects only wheat and oats but otherwise is similar to that of western wheat mosaic.

Green mosaic virus, obtained from spring wheat, produces mild symptoms on wheat and is the only virus studied that infected rye. The spring-wheat

varieties were moderately susceptible, while the durumms were immune or highly resistant. The incubation period was 15 to 30 days on wheat and only 10 to 20 days on rye.

Because of the nature of these virus diseases, control is difficult unless resistant varieties can be developed. The damage caused by western wheat mosaic may be reduced somewhat by delaying planting in the fall until conditions are unfavorable for the development of insect vectors.

Microfilm copy of complete manuscript of 83 pages, \$1.04. Enlargements 6" x 8" 10¢ per page.

## PSYCHOLOGY

THE RELATION BETWEEN THREE-DIMENSIONAL  
VISUALIZATION AND MENTAL-SPATIAL-  
MANIPULATION

(Publication No. 3870)

Mohamed Abdel-Salam Ahmed, Ph. D.  
Columbia University, 1951

## The Problem

The problem of this study was to investigate the relation between static-spatial-visualization and mental-spatial-manipulation. Although the possibility of the existence of these two abilities has been recognized for many years, it was only recently that one of these abilities actually appeared as a factor. A spatial-visualization factor has appeared vaguely in some recent factorial studies and has manifested itself clearly in the AAF study. Because most of the visualization tests which had considerable loadings on this factor seemingly involved movement, investigators concluded that static-spatial-visualization and mental-spatial-manipulation were the same ability. However, it was the writer's belief that the tests which were used and the bases relied upon in reaching that conclusion were not adequate enough to permit final judgment.

## Tests

The following thirteen tests were used in this study:

A. Three-Dimensional-Visualization Parts I and II, and Mental-Spatial-Manipulation Parts I and II. These four tests are from five tests devised by the writer to serve as tools more refined than the available tests. The final forms of these tests are the result of experimental forms which were examined for such different aspects as intercorrelations with known spatial tests, reliabilities, timing, understandability of instructions, item analysis, and interviews and group questionnaires for investigating the mental processes involved in answering these tests.

B. Block Counting, Hands, and Lozenges A from Thurstone's Primary Mental Abilities tests.

C. The Differential Aptitude Tests (excluding the Language Usage test).

#### Subjects

239 eleventh-grade boys who took all the tests, 132 from Newark, New Jersey, and 107 from Lower New York State.

#### Treatment of Data

Finding significant mean-differences between the two subgroups, the effect of subgroup differences on the product-movement intercorrelations was partialled out. For this purpose the point-biserial correlations based on the two subgroups were used. The partial correlations of the thirteen tests were submitted to Thurstone's complete centroid method. Five orthogonal factors were extracted.

Inspection of sizes and distribution of the fifth factor residuals, the sizes of the communalities computed from the extracted five factors, and the intercorrelations reproduced from the loadings of the thirteen tests on the a problem in order that the inherent interrelationships may be discovered or a solution found.

On the basis of the suggested general nature of manipulative ability, the writer has tentatively described this ability as if it consisted in a sort of mental flexibility which is involved in the process of mentally reorganizing the elements of a problem or a situation.

Since this is the first time that this factor has been isolated, it is hoped that the findings, interpretations, and devised tests of this study will stimulate further investigations in this field.

Microfilm copy of complete manuscript of 151 pages, \$1.89. Enlargements 6" x 8", 10¢ per page.

### FUNCTIONAL INTERRELATIONSHIPS OF WORD ASSOCIATION, PERCEPTION, LEARNING, AND MEMORY

(Publication No. 3877)

Beatrice Irene Bryan, Ph.D.  
Columbia University, 1952

This study had as its purpose the investigation of the hypothesis that the individual's behavior in response to personally relevant stimuli is governed by comparable or functionally equivalent processes in word association, perception, learning, and memory. Equivalence was defined operationally. On the one hand, delayed association time, increased latency of perception, slowness of learning, and failure at recall were considered functionally equivalent; on the other hand, very rapid association time, low thresholds of perception, rapid learning, and successful recall were considered functionally equivalent.

The experiment was designed to (1) set up tasks

requiring the functions of association, perception, learning, and memory in response to the same objective stimuli and (2) determine the functional equivalence or non-equivalence of the individual's responses to these stimuli. Stimuli were words covering a wide range of affect, but of approximately equal length and familiarity.

Twenty-five college students, 12 male and 13 female, between the ages of 18 and 33, served as subjects in the experiment.

The procedure consisted of four parts: (1) administration of a word association test by means of a two-way voice key channel; (2) administration of part of the same words as a perception test by means of a modified Dodge tachistoscope; (3) learning of paired associates, each pair consisting of a word common to the two preceding lists and a nonsense syllable rated as having zero meaning; (4) testing of subjects for retention of paired associates.

Data were analyzed by the following statistical procedures:

1. Correlations for each individual between each variable paired with every other variable, point biserial being used where recall was one of the variables and Pearson product-moment correlations elsewhere.
2. Rank-order correlations for each individual for each pair of variables except those involving recall.
3. Means and standard deviations for each individual for each variable.
4. Chi squares on agreement of signs of obtained correlations with signs expected under the hypothesis.
5. t-tests of the significance of the means and chi-square tests of variance of the sampling distributions of correlations.
6. Chi squares for individual and group data for each pair of variables distributed into a four-fold table according to whether the scores fell above or below the subject's own median on word association, perception, and learning, and according to whether the words were remembered or forgotten on the recall test.
7. t-tests for significance of the means of difference scores for the extremes on word association, perception, and learning when compared with all words in association time, perception time, and number of learning trials.
8. Test-retest reliability correlations for eight experimental subjects and three non-experimental subjects.

Pre-perception hypotheses were classified by two judges on the basis of structure and meaning.

The following conclusions were supported:

1. In general, the individual data failed to support the hypothesis, only a few correlations being significant.



2. Group data showed significant relationships (1) between word association and (a) perception, (b) learning, and (c) recall and (2) between learning and recall. Other relationships were not significant.

3. For some variables significant relationships existed for the extremes of the distribution of scores but not for the entire range.

4. The marked individual variability makes dangerous the application of generalizations derived from group data to individual cases.

5. Further study of relationships of these variables within the individual is needed.

6. More reliable and valid measures of behavior in these four areas are needed.

Microfilm copy of complete manuscript of 88 pages, \$1.10. Enlargements 6" x 8", 10¢ per page.

#### ABSTRACT SETS MEASURED BY THE PICTURE SIMILARITIES TEST

(Publication No. 3683)

Seymour Irving Canter, Ph. D.  
Columbia University, 1951

An experimental test was constructed to investigate the relationship between preference for types of abstraction (abstract sets) and: (1) analogous types of perception, (2) intellectual ability, and (3) emotional maladjustment. Each of the 15 test cards is composed of five pictures and offers the subject an opportunity to find similarities in (1) color, (2) human movement, (3) configuration (whole), and (4) detail. Under time-pressure, the subject first chose one response, his Initial Preference, as the "most different" picture on each card. The subject was then re-shown the cards, given an opportunity to explore them more thoroughly, and was asked for alternate categorizations. The experimental variables were Initial Preferences for each type of abstraction, and Total Preferences for each type.

The test was administered to 51 pairs of subjects (N=102). Each subject in the "experimental group" was judged to be psychiatrically disturbed and was matched man-for-man on Age, Education, and I.Q. with a subject in the "control group" who was judged to be free from psychiatric disturbance. Since care was taken to exclude patients from the disturbed group upon evidence of psychotic deterioration or organic involvement, the two groups of subjects could be said to differ, principally, in emotional adjustment.

Scores denoting preference for each of the modes of abstraction were shown to be reliable measures. The hypothesis that abstract sets are consistent patterns of behavior was shown to be tenable.

Comparisons between scores on abstract sets and scores on analogous perceptual sets (Rorschach

scores) did not warrant the conclusion that individuals who approached the Rorschach with particular perceptual sets, necessarily approached the experimental test with analogous abstract sets. Of 36 measures of relationship between abstract and perceptual sets, 7 were significant. The findings are taken as evidence of the limitations of analogy, by itself, as a basis for the formulation of behavior patterns. While the Rorschach test may or may not measure pervasive habit-patterns, the same individual who responds to a Rorschach variable on the ink-blot test may not necessarily respond to an analogue of that variable presented in a new context.

No direct relationships were established between scores on abstract sets and intelligence scores. Although some significant coefficients of correlation were found, they were shown to be attributable to a relationship between intellectual ability and general test responsiveness. The hypothesis that the experimental sets represent types rather than levels of intellectual activity was shown to be tenable.

Comparisons between the scores of a "normal group" and the scores of a "disturbed group" revealed significant differences between the groups but do not warrant the use of the test as an instrument for individual diagnosis. The test has served to show that, when ambulatory psychiatric patients are closely matched with "normal" subjects, differences may be obtained between the two groups in the type of approach to an abstract problem. The normal group, on Administration I of the test, gave significantly more abstractions based upon concrete details than did the disturbed group. On the total test, the normal group gave significantly fewer false abstractions. The experimental findings are taken to warrant extension of Heidebreder's explanation of the process of concept formation, that subjects tend to prefer to react to thing-like aspects of the environment, to account for characteristic differences between the concept formation of normal and abnormal persons.

Microfilm copy of complete manuscript of 91 pages, \$1.14. Enlargements 6" x 8", 10¢ per page.

#### A STUDY OF ROLE CONFLICT AMONG FOREMEN IN A HEAVY INDUSTRY

(Publication No. 3733)

Werrett Wallace Charters, Jr., Ph.D.  
University of Michigan, 1952

The intent of this thesis is to point toward a social psychological theory to account for the conditions under which individuals will interiorize conflicting expectations concerning their behavior. Especial reference is made to the conflict of expectations between management and workers in regard to the behavior of foremen which lead the latter to feel "in the middle" between their superiors and subordinates.

Empirical data from an interview survey of one



American automobile factory are brought to bear upon the arguments implicit in the writings of F. J. Roethlisberger, W. E. Moore, B. B. Gardner, W. F. Whyte, and D. E. Wray to show the inadequacy of these arguments to account for the differences in the extent to which foremen interiorize conflicts existing in the structural organization of present-day industry. The data cast doubt upon the formulations of these and other industrial sociologists to the effect (1) that structural conflicts are uniform throughout an industrial unit, (2) that these conflicts are interiorized automatically by foremen, (3) that all or most foremen in an industrial unit consequently feel that they are "in the middle," and (4) that such interiorized feelings of conflict result in insecurity and discontent among foremen.

On the basis of a social psychological theory of roles, this thesis points out that conflicting expectations are interiorized only if foremen interact with workers and management personnel who entertain the conflicting expectations, if foremen perceive accurately the contradictory nature of the expectations, and if foremen are motivated to conform to both the expectations of workers and the expectations of management. The empirical data show that only one-half of the foremen in this automobile plant have interiorized a feeling of being "in the middle" and that the majority of these foremen accept the situation as a legitimate aspect of their job and are neither insecure nor discontent.

The theory of roles developed here is proposed as a basis for testable hypotheses which state the conditions under which structural conflicts are interiorized by persons exposed to them. It is intended to supplement more macroscopic theories which account for the conditions under which structural conflicts develop.

Microfilm copy of complete manuscript of 155 pages, \$1.94. Enlargements 6" x 8", 10¢ per page.

#### SOME PERSONALITY AND SOCIAL CORRELATES OF SOCIAL INSIGHT AND CONFORMITY

(Publication No. 3744)

Harold Feldman, Ph. D.  
University of Michigan, 1952

Although previous research in the area of the empathic skills has focused primarily on the ability of a person to estimate the attitudes of another individual, viewed in the light of its social consequences, the ability to estimate the attitudes held in common by a group of people (social insight) appears to be a promising problem for research. A pilot study of the relationship between degrees of social insight and selected personality measures suggested that it would be necessary to study not only "social insight" but also the degree to which a person modified his own behavior on the basis of his knowledge of the group norm. Some subjects

when aware of the group norm tended to agree with the group consensus (over-conform) and others to disagree (under-conform). Still other subjects equally aware of the group norm seemed to act more independently of this knowledge (moderately-conform).

The major hypothesis of the present study was that the Moderate-Conformers would have characteristics indicative of more adequate social and personal adjustment than either the Non-awares, the Over-Conformers or the Under-Conformers. In order to test this hypothesis a number of structured questionnaires and personality inventories were administered to a sample of 142 college students (70 men and 72 women) from three fraternities and three sororities. The members of each house had lived together for at least six months and knew each other well.

The sample was first divided by sex and then within each sex was divided further into six groups on the basis of the degree of agreement between a series of ranking of house members on "popularity." These groups were:

1. Aware and Over-Conforming
2. Aware and Moderate-Conforming
3. Aware and Under-Conforming
4. Non-Aware and Over-Conforming
5. Non-Aware and Moderate-Conforming
6. Non-Aware and Under-Conforming

Since the three Non-Aware groups did not differ significantly on any of the measures of adjustment, they were combined into a single category, making a total of four groups to be compared with respect to the personality measures.

1. Aware and over-conforming (Over-Conformers)
2. Aware and moderate-conforming (Moderate-Conformers)
3. Aware and under-conforming (Under Conformers)
4. Non-Awares

The men and women subjects were then compared to each other on measures of conformity, and adjustment. In those instances in which the differences were not significant the data for the men and women were combined. The above four groups were then compared to each other on each of the measures of adjustment. For all measures on which there were significant differences between groups, the data for each measure of adjustment were examined to determine whether the Moderate-Conformers had the predicted position of more adequate adjustment.

Based on the findings of this study, the following conclusions appear justified:

1. Moderate-Conformers have personality characteristics indicative of generally superior personal and social adjustment.
2. Over-Conformers have characteristics indicative of adjustment at the level next to that of the Moderate-Conformers with the Non-Awares following and the Under-Conformers have Characteristics indicative of the lowest level of adjustment.
3. The degree of conformity of a group norm does not distinguish between the personal and social

characteristics of those who are equally non-aware of the group norm.

4. The men and women subjects are similar to each other on measures of social awareness and social conformity.

5. Except for the Under-Conformers, the men and women are similar to each other on the measures of adjustment. The men and women Under-Conformers tend not only to differ from their own sex group on the measures of adjustment but also from each other.

6. Both social awareness and social conformity appear to be independent of various demographic factors such as age, religious affiliation, number of years in college, and major areas of specialization.

7. Persons who have little insight into the feelings of others toward others also tend to have little insight into the feelings of others toward themselves.

Microfilm copy of complete manuscript of 88 pages, \$1.10. Enlargements 6" x 8", 10¢ per page.

#### STIMULUS SATIATION AS AN EXPLANATION OF SPONTANEOUS ALTERNATION IN RATS

(Publication No. 3753)

Murray Abraham Glanzer, Ph. D.  
University of Michigan, 1952

This study is designed to explore one possible determinant of variability in animal behavior. Variability is important because of its adaptive significance. One of its simplest expressions is spontaneous alternation – the tendency of rats to vary choice systematically between two alternative alleys.

Empirical findings on spontaneous alternation and a generally accepted explanation are discussed. This explanation is based on the reactive inhibition concept. It states that animals that have made one response tend to inhibit that response and therefore to make, next, a different response.

Since some findings seem to contradict this explanation, another, in terms of the stimulus, is proposed. This is based on the concept of stimulus satiation, defined in a postulate:

Each moment an organism perceives a stimulus-object or stimulus-objects, A, there develops a quantity of stimulus satiation to A. This reduces the organism's tendency to make any response to A.

From the postulate deductions are drawn concerning the effect of several variables on spontaneous alternation. Three deductions are then tested.

First, is the deduction that subjects actually alternate alleys, not responses; therefore, if alleys are switched, subjects will tend to repeat responses. Reactive inhibition implies that subjects will continue alternating responses.

Twenty-six rats are given a pair of trials daily for eight days. On four days the animals start both trials from the same point. Here response alternation

is also alley alternation. On the other four days the animals start the two trials from different points. Here the animals can either alternate responses (repeat alleys) and thus verify the reactive inhibition explanation, or, they can repeat responses (alternate alleys) and verify the stimulus satiation explanation. In the experiment, the animals do the latter.

Another deduction that is tested relates effect of inter-trial delay on spontaneous alternation to place of delay. If, after trial one, subjects are detained in the end box spontaneous alternation will increase. If, however, the subjects are detained at any other point spontaneous alternation will decrease. Reactive inhibition implies that place of delay is irrelevant. To test the deduction, twenty-five rats are given each a pair of trials under each of three conditions – detention in end box, starting box, choice point box. Results substantiate stimulus satiation and contradict the reactive inhibition explanation.

Finally, the deduction is tested that spontaneous alternation will decrease with each successive trial in a series. Twenty-five rats are given six immediately successive trials in a T-maze. The results here are not conclusive.

The conclusion from the experiments is that within the area of spontaneous alternation, the stimulus satiation explanation is verified whereas the reactive inhibition explanation is contradicted.

In addition, implications of the stimulus satiation postulate for other, more complex situations are derived.

Microfilm copy of complete manuscript of 132 pages, \$1.65. Enlargements 6" x 8", 10¢ per page.

#### INTELLECTUAL RIGIDITY AND SOCIAL ATTITUDES

(Publication No. 3886)

Leonard David Goodstein, Ph. D.  
Columbia University, 1952

The present study was designed to investigate the general hypothesis that persons who are intellectually rigid will have both more consistent and more extreme social attitudes than persons who are non-rigid. In view of the lack of agreement in contemporary psychology on a definition of rigidity, rigidity was operationally defined as the continuance of previously learned techniques of problem solving when those techniques no longer represent the most efficient and direct means of solving the problem.

The specific hypotheses were:

1. Persons who are intellectually rigid will have more extreme social attitudes than non-rigid persons.

2. Persons who are intellectually rigid will have more stable social attitudes than non-rigid persons.



Rigidity was measured by three tests:

1. The water-Jar Problems. Ss were required to solve problems in which required quantities of water were obtained by manipulating three jars of given capacity. A set was established by presenting problems solvable in only one, complicated method. Then followed a series of critical problems, solvable both by a complicated and by a simple method. The solutions to the critical problems by the complicated method were considered rigid.

2. The Shipley-Hartford Retreat Scale. Ss were required to complete the Vocabulary and Abstraction Tests under reduced time limits. Low C.Q.'s (Abstractions Score/Vocabulary Score) were considered rigid as the Abstraction Test required more rapid shifting of mental set than the Vocabulary Test.

3. The Anagram Problems. Ss were required to solve a series of five anagrams by rearranging the letters. A set was established by presenting anagrams solvable in only one rearrangement pattern. Then followed a series of critical anagrams, solvable both by the old set way and by other new ways. Solutions to the critical anagrams by the old set way were considered rigid.

Social attitudes were measured by four of the Thurstone Attitude Scales: Bible, Censorship, Patriotism and Law. Two scores were available for each S on the attitude scales: the intensity and direction of the attitude and the test-retest differences on alternate forms of each scale.

These measures were administered to 150 college students enrolled in a course in General Psychology. While the results were kept anonymous, the age, sex and college class were obtained for each S.

As no statistically significant relationships could be demonstrated among the three tests of rigidity, by coefficients of correlation (which were not significantly different from correlation ratios), the concept of a unitary trait of intellectual rigidity was not confirmed. Further, no significant inter-correlations could be demonstrated between intellectual rigidity, independently defined by each of the three tests of rigidity, and the intensity of the social attitudes. No evidence was found to support the first hypothesis concerning the presumed relationship between the extremity of social attitudes and intellectual rigidity.

In testing the second hypothesis, the correlation of the attitude scales test-retest differences and the rigidity test scores ( $r_{(x-y)_a}$ ) was used. As these correlations were not significantly different from zero, the second hypothesis was not confirmed.

It was further concluded that: (1) It is difficult to maintain a concept of rigidity, even intellectual rigidity, as a unitary psychological trait; (2) Intellectual rigidity, as it has been conceived, was not a necessary concomitant of extreme or stable social attitudes.

After considering the various implications of these results, it was concluded that, at the present time, rigidity does not seem to be a useful intervening variable in discussing the relationships

between the antecedent conditions and the consequent behavior of normal individuals. While both social attitudes and intellectual rigidity have been defined in terms of behavioral consistency, this similarity in definitions should not be taken as proof of similarity in process.

Microfilm copy of complete manuscript of 59 pages, \$1.00. Enlargements 6" x 8", 10¢ per page.

#### A STUDY OF MEASURED PERSONALITY VARIABLES AND THEIR BEHAVIORAL CORRELATES AS SEEN IN OIL PAINTINGS

(Publication No. 3946)

John Lewis Holland, Ph. D.  
University of Minnesota, 1952

This study is an attempt to validate a number of painting-personality hypotheses. While there are many hypotheses about the relation of the painter's personality to painting, most of the evidence for these relationships is ambiguous because of the lack of adequate experimental design. In order to clarify this evidence, the design of this experiment includes a control group, a psychometric criterion, and a set of reliable categories for judging paintings.

The painting categories were obtained from a survey of the literature and cast into simple verbal statements which could be judged "true" or "false" of a particular painting. A group of 112 statements were selected as having sufficient reliability for a test of validity. The per cent of agreement among three judges for the scoring of these statements is 89.8.

A group of control (40 college students) and a group of hospital subjects (39 patients with functional behavior disorders) were selected so that these groups were of comparable age, intelligence, art training, socio-economic status, and about equal division by sex.

Paintings were secured from all subjects by using a standard set of materials and directions. The Minnesota Multiphasic Personality Inventory (MMPI) was also administered to each subject.

The relation of each painting category to the nine MMPI scales was obtained by an item analysis. The scoring of each painting category was correlated with each of the MMPI scales. This analysis resulted in 2,464 coefficients.

The relation of painting categories to source of sample was determined in order to investigate the effect of hospitalization upon painting behavior. In general, hospitalization does not affect female painting behavior. Male painting behavior, however, is significantly affected by hospitalization. Since the painting behavior of both males and females is more closely related to personality variables (the MMPI scales detect three to five times as many significant relationships) the findings are concerned primarily with the relation of MMPI scales and scoring categories.

The large number of hypotheses tested precludes their enumeration here. The major findings, therefore, are summarized below. These relationships are significant beyond the 5 per cent level.

It is possible to score oil paintings by means of verbal statements and secure a high per cent of agreement among judges. Explicit, measurable scoring categories for paintings are not necessarily more reliable than highly subjective categories.

Male "high" scorers on the MMPI scales produce paintings characterized by: disorganization; crossed lines; oscillating lines; solid areas of color; male sexual symbols; small forms; presence of yellow-red; and blue-green.

In contrast, male "low" scorers produce paintings characterized by: the absence of oscillating or crossed lines; presence of religious symbols; good organization; large forms; bilaterally symmetrical forms; use of lines and single brush strokes rather than masses of color.

Female "high" scorers produce paintings characterized by: grouping of forms in a small area of the picture; excessive shading; use of red; small brushes; description of "depressing"; presence of landscapes; doodling; and dominance of color over form.

Female "low" scorers produce paintings characterized by: use of grey to white; red-purple; use of yellow; presence of male sexual symbols; use of internally elaborated forms; asymmetrical forms; presence of female figures; dominance of form over color and presence of containers.

A comparison of male and female paintings reveals no significant differences in painting behavior.

Microfilm copy of complete manuscript of 197 pages, \$2.46. Enlargements 6" x 8", 10¢ per page.

#### THE MINNESOTA MULTIPHASIC PERSONALITY INVENTORY APPLIED TO THE PROBLEM OF PROGNOSIS IN SCHIZOPHRENIA

(Publication No. 3948)

William Lorne Jenkins, Ph.D.  
University of Minnesota, 1952

The aim of this study was to assess the feasibility of determining prognosis by means of a personality test, the Minnesota Multiphasic Personality Inventory, for patients within a psychiatric diagnostic category, paranoid schizophrenia.

A total of 166 cases were obtained from the records of the Psychiatric Section of the Veterans Administration Hospital, Minneapolis, Minnesota which met the requirement of the above diagnosis who had been discharged from this hospital at least a year before the time at which this study was begun and who had been given the MMPI on admission to the hospital.

The records of various hospitals were searched, and it was discovered that 16 per cent of the total

were currently in hospitals. The remaining patients were canvassed by means of a mail questionnaire or traced through social service department records, and in all, information sufficient to afford an estimate of social and economic recovery was obtained for 142 cases, or 85.5 per cent of the total sample. The follow-up data for these cases were rated and each case assigned to one of five recovery groups, ranging from best to poorest. Group 1, composed of patients with virtually unbroken work records, who denied symptoms, comprised 11 per cent of the total. Group 2, composed of patients with work records nearly as good as Group 1, but who admitted symptoms, made up 26 per cent. Group 3, indeterminate in respect to recovery, amounted to 19 per cent. Group 4, composed of patients who had worked very little or not at all, comprised 24 per cent. Group 5, composed of patients who had remained in some hospital since discharge from the Minneapolis Veterans Hospital, made up 20 per cent.

It was found that the five groups did not differ significantly in respect to age, marital status, intelligence, and socio-economic status, gross type of symptom, certain features of the psychiatric history, and the type of treatment administered. The cases showing better recovery were found to have significantly more education, fewer previous hospitalizations, a shorter duration of illness, and tended to be rated more optimistically in respect to prognosis made at time of discharge. Because of many trend reversals and the degree of overlap among the groups in respect to these variables it was not deemed necessary to attempt to control these factors.

The MMPI records of the five groups were analyzed by several methods. No significant differences were found for mean scores on any of the clinical scales using the analysis of variance technique, but D (Depression) was somewhat higher and Ma (Hypomania) was somewhat lower in the groups with better recovery, noting two trends which approached the 5 per cent level. Comparing the "codes," or the relative positions of the scales within the individual profiles, it was found that D and Pt (Psychasthenia) were relatively high in respect to other scales for the groups with better recovery. Insofar as was possible, the special criteria and the special scales developed by previous workers for the purpose of assessing prognosis were applied to the MMPI records, but these were not found to discriminate significantly among the groups. A social-status scale developed on the hospital population by another worker showed significant differences among the groups, the cases with better recovery tending to have higher social status scores. None of the trends observed on the various scales were definite enough to make for practical discrimination among the groups.

A Prognosis Scale and a Prognosis Index were developed which were found to discriminate between cases showing good and poor recovery. Using these two measures simultaneously, it was found that something over half of all cases could be classified as to good or poor prognosis with sufficient accuracy



to be of use in practical prediction. The method was shown to predict outcome more efficiently than did the psychiatrist at time of discharge.

In interpreting the Prognosis Scale and the Prognosis Index, the hypothesis was advanced that the Prognosis Scale measures the presence of certain malignant character traits and of affect, and that the Prognosis Index measures anxiety and depression, or possibly the "state of affect." The prognostic literature has indicated that the absence of certain character defects and the presence of adequate affect are indicative of good prognosis.

Microfilm copy of complete manuscript of 187 pages, \$2.34. Enlargements 6" x 8", 10¢ per copy.

#### A COMPARISON OF TWO METHODS OF COLLECTING DATA FOR SOCIAL RESEARCH: THE FIXED-ALTERNATIVE QUESTIONNAIRE AND THE OPEN-ENDED INTERVIEW

(Publication No. 3776)

Robert Louis Kahn, Ph. D.  
University of Michigan, 1952

This study is an experimental comparison of two major devices for collecting social data - the personal, non-directive interview and the paper-and-pencil questionnaire. The purposes of the study are to demonstrate the systematic differences in results obtained by these two methods of data collection in an industrial situation, and to make some contribution to understanding and conceptualizing the forces which encourage, direct, or inhibit communication in inter-personal situations.

The hypotheses are based upon the postulate that employee motivation to communicate about the work situation depends primarily on the perceived possibility of such communication bringing about improvements in the situation, and secondarily on the immediate psychological rewards of expressing opinions on a subject which is important; and that the major barrier to communication in such a situation is the employee perception that critical statements may be personally disadvantageous, if it is possible to identify the authors of such statements. The specific hypotheses are as follows:

1. Differences in response between the questionnaire and interview will be minimal for "safe," demographic, kinds of items, and will be maximized for items demanding approval or criticism of superiors, company policy, etc.
2. Differences in response between the questionnaire and interview will be in the direction of the questionnaire showing fewer "management-stereotypes" and more intensive expressions of dissatisfaction and criticism.
3. The proportion of non-response will be less for the questionnaire than for the interview.
4. The incidence of extreme responses will be greater for the questionnaire than for the interview.

5. The ability to predict criterion scores (productivity) from a given question will be greater for the questionnaire than for the interview.

The hypotheses were tested by means of anonymous questionnaires and personal interviews which involved the identification of the respondent. Identical questions about the work situation were asked of 206 industrial employees by means of these two devices for data collection. The results are as follows:

Hypothesis 1 was confirmed; mean agreement between questionnaire and interview responses varied from 82 per cent for factual "low-threat" items to 37 per cent for high-threat, attitudinal items.

Hypothesis 2 was confirmed. Questionnaire responses showed significantly more criticism and hostility for 22 questions; interview responses were more critical for two.

Hypothesis 3 was not confirmed; the findings were in the predicted direction, but were not significant. Analysis showed the results to be confounded by the unpredicted factor of difficulty in comprehending some of the written questions.

Hypothesis 4 was confirmed. Responses to 13 questions showed significantly more dispersion for the questionnaire; the reverse was true for only three questions.

Hypothesis 5 was supported by the data, but only four questions were related to the criterion closely enough to permit a rigorous test of the hypothesis. The results were in the predicted direction for all four, and were significant for two.

The data suggest three major conclusions:

1. Under specified conditions, the anonymous questionnaire offers some advantages over the interview.
2. Unwillingness to communicate causes measurable distortions of response.
3. A framework for studying communication in the data-collecting situation is proposed.

Microfilm copy of complete manuscript of 255 pages, \$3.19. Enlargements 6" x 8", 10¢ per page.

#### THE RELATION OF FOOD DEPRIVATION TO CERTAIN MEASURES OF PERCEPTION

(Publication No. 3778)

Florenz Dudley Klopfer, Ph. D.  
University of Michigan, 1952

##### Problem

A study was designed to investigate the deprivation functions and intercorrelations of four measures of perception, one measure in accord with each of the following definitions:

1. Perception (Subception) is a correct discriminational response in a situation where the perceiver is unaware of the basis for discrimination.
2. Perception (Discrimination) is a correct discriminational response in a situation where the

perceiver may or may not be aware of the basis for discrimination.

3. Perception (Accuracy) is a discriminative response in a situation where the perceiver accurately reports the object discriminated.

4. Perception (Naming) is the report of awareness of an object without respect to the accuracy of report or to the presence or absence of sensory stimulation.

Predicting from the experimental results of related studies and from the theoretical positions of Murphy, and Bruner and Postman, we hypothesized:

1. (a) Subception of food objects would increase monotonically with food deprivation.

(b) No significant trend for instrumental food or non food objects.

2. (a) Naming of food objects would be an inverted U-shaped function of food deprivation.

(b) Naming of instrumental food objects would increase at the higher deprivations.

(c) No significant trend for the non food objects.

3. With deprivation constant, no significant relationship between discrimination and naming.

4. The nature of the need-perception functions for discrimination and naming would differ significantly.

5. The need-perception functions for discrimination and accuracy would represent a transition from the subception to the naming function.

#### Procedure

Slides were constructed, each slide containing one pair each of food, non food, and instrumental food objects. On some slides one member of one of the pairs differed in some respect from its mate. Subjects were directed to report whether the two sides of the slide were alike or different, and if different, what object differed. One hundred twenty slides were presented tachistoscopically to 100 inmates of the Washington State Penitentiary, with one group of subjects at each of three deprivation periods: one, four, and sixteen hours. The study was repeated with sixty-eight subjects at the State College of Washington, using one, four, seven, and twenty-four hour deprivation groups. The studies were disguised as a test of a new drug.

#### Results and Conclusions

The data indicate that:

1. Food responses for all four measures increased with increasing deprivation.

2. Subception decreased at twenty-four hours deprivation.

3. Non food responses were not related to food deprivation.

4. Instrumental food responses (accuracy and naming) increased at sixteen hours deprivation.

5. Instrumental food responses (subception and discrimination) were not related to food deprivation.

The conclusions from comparison of the perceptual measures are that:

1. The four measures of perception do not bear dissimilar relations to need.

2. Discrimination, generally speaking, is not the same variable as accuracy or naming, thus indicating that the use of the term "perception" should be qualified by operational definition.

3. The correlations between discrimination and accuracy or naming increase with increasing food deprivations, indicating the unifying effect of need on otherwise disparate perceptual behaviors.

Microfilm copy of complete manuscript of 91 pages, \$1.14. Enlargements 6" x 8", 10¢ per page.

#### A STUDY OF CHANGES IN BODY IMAGE DURING PSYCHOTHERAPY

(Publication No. 3619)

Jerome William Kosseff, Ph.D.  
New York University, 1952

This investigation sought to determine whether changes in body image, as projected in periodic Human-Figure drawings, were related to changes subjects underwent in the course of psychotherapy.

The experimental group consisted of the first twenty-five World War II veterans, white males nineteen to thirty-seven, who agreed beforehand to make periodic Human-Figure drawings and to permit electrical recording of their interviews, and had at least twenty interviews.

The control group consisted of the first twenty-five white male under-graduate evening students who voluntarily made periodic Human-Figure drawings and provided certain requested autobiographical information. No gross physical or mental disabilities were present in either group.

The procedure was to request: "Draw a whole person," before the start of the first therapeutic interview of each experimental, and in the first three weeks of the semester for each control, and every fifth week thereafter until five drawings had been obtained from each. Recordings were made of every interview with experimental subjects. The therapeutic methodology was largely non-directive.

The data were first treated by having two experts independently review the pairs of initial and final drawings of each subject, experimentals and controls separated and indicated. They pointed out the specific graphic characteristics seeming to change in different ways for the two groups over the entire four months. The characteristics indicated by them were then tested by physical measurement in millimeters where possible, or by the averaged ratings of three judges. There were thirty-one physical measures, twenty-two ratios of physical measures, twenty-eight rating scales and five discrete scales. The t-test of the significance of the differences in change between the means of the experimental and control groups was found for each of these. Before the results could be accepted, however, it was necessary to factor our variance



due to the items of "age," "education" and "IQ," which were significantly different for the experimentals and controls. After this analysis of variance, nine graphic characteristics remained as changing in significantly different ways for the two groups. It was also noted that experimentals changed more extremely on more of these nine graphic characteristics than controls.

To determine what had happened with these nine characteristics within the four-month period, the experimental subject with the most such extreme changes and the one with the least were studied in detail. Their intermediate drawings were measured just as the initial and final ones were. Trends of change for each graphic characteristic were then noted for each subject.

Four personality traits had been selected for this investigation: "Defensiveness-Differentiation," "Self-Evaluation," "Control-Spontaneity" and "Dependence-Independence." The investigator rated each of the five interviews of each subject response-by-response for these traits, and checked his reliability against the averaged ratings of three independent judges. Only "Control-Spontaneity" was not established as reliable. Then the changes in each graphic characteristic and each personality trait were compared graphically and statistically for each subject, and explanations for the findings given.

In conclusion, the body image, as projected in Human-Figure drawings within the limits of this study, was found to change (a) more extremely and in more ways, (b) in more comprehensive and integrated fashion, (c) in such special focal areas peculiar to each subject and (d) in closer diagnostic and prognostic relationship to psychotherapeutic changes in personality traits than could be accounted for by chance or in the ordinary course of life experience. Also, these changes showed up more definitively in ratings than in physical measurements.

Microfilm copy of complete manuscript of 421 pages, \$5.26. Enlargements 6" x 8", 10¢ per page.

#### AUDITORY PERCEPTION OF EMOTIONAL WORDS: A COMPARISON OF TWO GROUPS OF PATIENTS AND A NORMAL GROUP

(Publication No. 3896)

Shabse Howard Kurland, Ph.D.  
Columbia University, 1952

Recent studies of perceptual behavior have found that the "emotionality" attached to a word can have a significant effect on the recognition threshold at which the word can be correctly reported. While these investigations have been rationalized as the result of the perceiver's reacting adaptively to the anxiety aroused by the stimulus, there has been no precise formulation of the direction which this change in threshold takes, nor of the intra-individual variables to which it may be related. This study investigated

the hypothesis that the change in recognition thresholds is a function of the characteristic mode of coping with anxiety. It was hypothesized that a group of obsessive-compulsive patients who typically use intellectualization and similar mechanisms to allay anxiety would perceive emotional words at lower intensities (vigilant reaction), than would a group of hysterical patients who are characterized by their frequent use of repression in the face of anxiety (defensive reaction).

Neutral and emotional words, chosen from widely used lists by a process of agreement among a panel of psychologists, were recorded on a magnetic tape at successively higher intensities so that it was possible to obtain auditory recognition thresholds for each word. The patients were selected by their therapists, who judged the type of anxiety-reducing mechanisms characteristic of each patient.

No difference was found in the recognition thresholds between the obsessive-compulsive and hysterical patients as measured by the difference in the medians for the neutral and emotional words divided by the average interquartile range for the two groups of words for each subject. The two patient groups were then combined and compared with a group of normals to test the hypothesis that the greater amount of anxiety aroused by the emotional words among the patients would cause them to react with defensive and vigilant modes of perception of greater magnitude than would be found among the normals. This hypothesis was also untenable.

Using the same statistic as was used to compare the two groups of patients, a significant difference in the median recognition thresholds for the patient and normal groups was found, with the patients perceiving the emotional words at lower intensities than the normals.

An investigation of the recognition thresholds of individual emotional words for the two groups showed that seven of the twenty-one words were perceived at significantly lower thresholds by the patient group than by the normal group.

A possible explanation for the more vigilant perception of emotional words by the patient group is the increase in word frequency for these words among hospitalized patients who are frequently discussing their problems in psychotherapy.

The essentially negative results obtained in this investigation are interpreted as casting serious doubt on the generality of assertions in wide current use to account for the phenomena of social perception.

Microfilm copy of complete manuscript of 47 pages, \$1.00. Enlargements 6" x 8", 10¢ per page.

# SUPERVISORY TRAINING AND EMPLOYEE ATTITUDES

(Publication No. 3637)

Theodore Rudolph Lindbom, Ph.D.  
University of Minnesota, 1952

The purpose of this study was to evaluate the effects of a supervisory training program through before-and-after measurement of employee attitudes, and to demonstrate the utility of this method of evaluation.

The study was carried out in the home office of a small midwestern insurance company during the period of October, 1950 to May, 1951. A total of 50 persons, comprising all members of management in the home office, took part in the training program. The supervisors were a relatively young group, with fairly limited experience as supervisors, and they supervised small work groups. The employees were largely young females with relatively short tenure with the firm.

Attitudes of employees were measured one week before the start of and three months after the conclusion of the supervisory training program. All employees of the firm present on the days of the attitude surveys, 124 in the pre-training and 129 in the post-training surveys, took part. Supervisors were measured with alternate forms of "How Supervise?" before and after training.

The training program was carried out during working hours over a period of 16 weeks. Two groups of 25 supervisors each met separately once a week for an hour and a half. Training was conducted by two persons from outside the firm with previous experience in supervisory training. Course content included the following topics: (1) leadership, (2) the "human element," (3) individual differences, (4) duties of a supervisor in terms of organization, (5) selection, (6) interviewing, (7) induction and training, (8) handling complaints, (9) correction and discipline, (10) giving orders, (11) maintaining morale, (12) line and staff relationships, (13) evaluation of supervisory performance. A variety of training methods all designed to bring about active participation of the group were used including the conference method, role playing, and sound film strips.

The questionnaire used for measuring employee attitudes was an objective self-administering scale developed by the University of Minnesota Industrial Relations Center. This questionnaire is made up of 7 specific sub-scales which measure attitudes toward the company, communications, co-workers, hours and pay, supervisor, type of work, and working conditions. In addition, the total score on the scale measures general attitudes.

Results of the study were as follows: (1) supervisors made significant gains in score on the test "How Supervise?"; (2) the total group of employees showed significantly more favorable attitudes after supervisory training in all of the areas measured by the scales except hours and pay and working conditions; (3) female employees showed significant gains in attitude scores while male employees did

not; (4) employees with less than a year of service showed greater gains in attitude scores after supervisory training than employees with a year or more of service.

The results of the study show that the supervisory training program was successful, using employee attitude change as the criterion of success. The technique of evaluating supervisory training through before-and-after measurement of employee attitudes appears to be a useful one.

Microfilm copy of complete manuscript of 154 pages, \$1.93. Enlargements 6" x 8", 10¢ per page.

# CERTAIN CONTENT OF PREJUDICES AGAINST NEGROES AMONG WHITE CHILDREN AT DIFFERENT AGES

(Publication No. 3908)

Ibrahim Abdullah Muhyi, Ph.D.  
Columbia University, 1952

The aims of this experiment were mainly (1) to discover the age level at which white children manifest prejudices against Negroes; (2) to describe certain content of prejudices at different ages (7-14).

The materials used were:

1. A T.A.T. type test (Allport and Postman picture, subway scene);
2. Rumor tests: Rumor A, a descriptive statement of Allport and Postman picture; Rumor B, the picture itself used as a standard stimulus.

The subjects were white school children from the age of 7 to the age of 14. Groups were obtained chiefly from the upper middle class. Groups were obtained from schools in which there were a number of Negroes and schools in which there were no Negroes.

Analysis of the data (children's responses) was a content analysis.

The findings:

## A. T.A.T. Type Test:

1. According to our procedure and on the basis of the three pictures we used at the beginning, New York City children, up to age 7, did not seem to see Negro. At age 7 a few of them reported the Negro and some of those who reported seeing the Negro reported conflict between the white man and the Negro (see pp. 37, 38, and 39, age 7).

2. The attribution of anti-social action or hostility to the white man (phenomenon number 2). This phenomenon increased significantly with successive ages. This seems to show assimilation to cultural pattern or expectancy, or it could be social awareness on the part of the children.

3. The attribution of the anti-social action, fighting and quarreling, only to the Negro (phenomenon number 3) occurred in a minority of cases, and did not increase at ages beyond 9.

4. The attribution of anti-social action to both the white man and the Negro (phenomenon number 4)



increased significantly with successive ages. This seems to be either prejudice against Negroes, or it could be assimilation to cultural habit of perceiving the two men, and it does not necessarily mean prejudice.

5. This study indicated that prejudices increase with age (see Table VIII, p. 34). Example: "Some of the Negroes are bad and like to talk with women unkindly." . . . "They, the Negroes, are not allowed to ride in the bus." . . . "He, the Negro, is not as good as him, the white man." . . . "The Negro is pointing the razor at the guy." . . . "He, the white man, took the razor from him." . . . "No Negro is supposed to be in the train." . . . "He will stand in the back of the train." . . . "The Negro is drunk." . . . "They are discriminating against him, the Negro."

#### B. Rumor Tests:

1. No conflict is reported at age 7.
2. Phenomena 2, 3, and 4, which have been explained in the previous section, appear in the same way for the rumor test.
3. Shifting the razor from the white man's hand to the Negro's increased with successive ages. Again, this may show either prejudice to the Negro or assimilation to cultural pattern. This is assimilation to "verbal clichés." This does not necessarily mean prejudice.

These prejudices developed gradually with the growth of human beings. Children, it seems, grow in the direction of more conflict, prejudice, as we have seen, and as is shown in Table VII, p. 34, and Table IV, pp. 27-30.

The sign test for the T.A.T. type test shows significant differences between the two populations, all-white school population and mixed school population. There are more in the all-white school than in the mixed school who report conflict.

The Chi-square tests for the T.A.T. type test also show that there are more children in the all-white school who attribute the anti-social action to the Negro than in the mixed school. The children from the mixed school seem to show more social consciousness and awareness of the cultural pattern, in this respect, than the children from the all-white school, an awareness that it is the white man in American society who initiates the prejudice against Negroes. Therefore, there are more children in the mixed school who attribute the anti-social action to the white man than to the Negro, as our study showed.

Microfilm copy of complete manuscript of 83 pages, \$1.04. Enlargements 6" x 8", 10¢ per page.

### THE PERCEPTION OF MEANING IN SCHIZOPHRENIA

(Publication No. 3910)

Charles Edmond Orbach, Ph.D.  
Columbia University, 1952

A perceptual experiment was conducted with a rationale based on confirmed psychiatric observation

of the disturbance in affective social relationships accompanying schizophrenia. It was assumed that this disturbance would be reflected in the perceptual reports by schizophrenic patients to tachistoscopically presented pictures depicting affective social interaction. It was hypothesized, therefore, that patients in the beginning acute stage of schizophrenia would misinterpret the affective social interaction and that chronic patients would exclude it from their perceptual reports.

Six pictures were tachistoscopically presented for four exposures in succession in the uniform order of one-hundredth, one-twenty-fifth, one-fifth and one second. Four of the pictures were of affective social interaction between two people and two of an affective experience for a single person. Three groups of thirty Normal Control, thirty Acute Schizophrenic and thirty Chronic Schizophrenic subjects matched for education and age at time of hospitalization were used in the experiment. The perceptual reports were coded by a qualitative method and scored by a scaling procedure. In the qualitative method descriptive and affective aspects of the pictures were identified and the frequency with which each was reported by the three groups determined. Scales were constructed based on rankings of the reports at one-hundredth of a second for the three dimensions of Omission, Addition and Social Relations. The reports were also ranked for the extent of Expressed Emotion but this dimension was not scaled because of its high correlation with Social Relations. The following conclusions were arrived at based on the statistical analysis of scaled scores from the three dimensions of Omission, Addition and Social Relations and the qualitative aspects of the perceptual reports.

1. Perceptual reports by schizophrenic patients to pictures with affective social content are more heterogeneous than those by normal subjects. This is particularly true of chronic patients because many of them omit the descriptive aspects on shorter exposures and the affective social content on longer exposures.

2. All groups gain significantly in the completeness and accuracy of perceptual reports between each exposure. This indicates that cognitive factors operate with considerable adequacy even in the perception of chronic schizophrenic patients.

3. All groups gain significantly in the extent of social interaction reported to the four two-person pictures between exposures 1 and 2 and between 2 and 3. Only the Normal group, however, continues to gain significantly between exposures 3 and 4. The gain between exposures 1 and 2 involves primarily an increase in the reports of physical closeness and between the longer exposures an increase in the reports of the affective interchange.

4. The Normal group omits significantly less than the Chronic group on each of the four exposures and significantly less than the Acute group on exposures 3 and 4. The Acute group omits less than the Chronic group on each of the four exposures but none of the differences are significant. The significant differences between the Normal and Acute groups on exposures 3 and 4 and the lack of

significant differences between the two schizophrenic groups is due to the exclusion of incongruent social interaction from the Omission scale.

5. The extent of social interaction reported to two-person pictures by the Normal group is significantly larger than that reported by the Chronic group on exposures 2, 3 and 4. The Normal group consistently reports more social interaction on each of the exposures but does not differ significantly from the Acute group on any of them. The extent of social interaction reported by the Acute group is significantly larger than that by the Chronic group on exposures 3 and 4. The inclusion of incongruent social content on this scale, therefore, reverses the findings between the Normal and Acute and Acute and Chronic groups on the Omission scale.

6. None of the groups are significantly different from each other in the extent of addition reported to any of the four exposures. The reports by the Chronic group however, are significantly more variable than those by the Normal group on exposures 2, 3, and 4 and those by the Acute group on exposures 3 and 4.

An experiment with non-affective pictures of comparable complexity would make possible the conclusion that the differences in perception were due to either lower perceptual discrimination in schizophrenia or to the nature of the affective content.

Microfilm copy of complete manuscript of 141 pages, \$1.76. Enlargements 6" x 8", 10¢ per page.

#### SOCIAL POWER AND INTERPERSONAL ADJUSTMENT

(Publication No. 3798)

Sidney Rosen, Ph.D.  
University of Michigan, 1952

This is a study of the relationship between an individual's adjustment to his interpersonal environment, and his potential ability to influence others. The investigation arose within the framework of a wider program of research into social influence processes within children's groups. The goal of the over-all research program was the gathering of systematic theoretical insights which would be of eventual help in using the group as a milieu for therapeutic change.

Two general hypotheses were formulated: maladjusted individuals introduced into a new group setting among peers who are also maladjusted, will (a) again demonstrate inadequacy in coping with the perceptual aspect of their interpersonal relations, by showing relatively inappropriate perceptions of own power and others' power, and will (b) again demonstrate inadequacy in coping with the behavioral aspects of their interpersonal relations, by showing relatively inappropriate influence behavior.

These propositions were broken down, in turn, into specific hypotheses. It was predicted that the maladjusted individuals, as compared to the adjusted

persons, would show less accuracy in evaluating own power, would agree less among themselves about who occupies what position of power, would be less successful in influencing others, would show less consistency in selecting targets for influence attempts, and would generally show less ability to anticipate the consequences of their actions.

Sixteen cabin groups of pre-adolescent and young adolescent boys were studied in two contrasting summer camps. One population consisted of 63 social agency referrals, the other of 65 relatively adjusted middle class boys in a YMCA camp. Two research teams observed influence behavior daily, using pre-categorized coding sheets. Interviews were conducted with each boy, using standardized instruments to obtain self-other evaluations on power.

The results supported the above hypotheses. Problems of interpretation arose with regard to other existing differences between camps. Since the two populations differed also with regard to socio-economic class, a separate analysis, using similar hypotheses, was made within the single camp of relatively maladjusted boys, thus minimizing class differences. The population of lower class agency referrals was differentiated, by an index of maladjustment constructed out of case history material, into relatively more and relatively less adjusted boys. The results indicated that the relatively adjusted subjects tended to be more accurate in evaluating their own power, as well as the power of other group members. Not only was greater power attributed to them by their peers, but they were also observed to be relatively more successful in influencing others. In summary, this second set of results lends additional support to the results obtained between the two camp populations.

The findings indicate that social power is significantly related to interpersonal adjustment. They also indicate that successful prediction to a new social context is possible, given sufficient knowledge about the generality of maladjustment symptoms. Implications of the findings are discussed with reference to communication theory and with regard to the formulation of a genetic theory of social power. The results also have important implications for the clinical practitioner.

Microfilm copy of complete manuscript of 131 pages, \$1.64. Enlargements 6" x 8", 10¢ per page.

#### FORMING IMPRESSIONS OF PERSONS FROM VERBAL REPORT: A STUDY OF SCHIZOPHRENIC AND NORMAL GROUPS

(Publication No. 3915)

Gerald Donald Rosenbaum, Ph.D.  
Columbia University, 1952

Forming impressions of others on the basis of what one hears or reads about them is a common human experience and one which would be expected to reflect interpersonal relationships. This study



has been concerned with whether a mentally ill population is any different from a normal one in its response to descriptions of other people and, if it is, what the nature of the difference may be.

Specifically, it has been asked whether schizophrenics, if they are given descriptions of two different persons, tend to reject any implied differences in personal warmth and minimize any differences in their own feelings of affection for the persons described; whether they are less able to shift voluntarily from a first impression they have formed to a second impression, and less able to integrate discrete elements of the descriptions; whether they impose their private preoccupations to a greater degree on what they are told about others; and, finally, whether schizophrenics differ not only from normal persons but from each other with respect to these questions.

The experimental sample consisted of sixty schizophrenic patients from Northport Veterans Hospital, of whom thirty subjects were closed ward and thirty were open ward patients so that two groups which differed with respect to ability to care for themselves could be studied. Psychiatric ratings were secured which indicated that the closed ward group was in poorer contact with its environment. A control group of thirty subjects was selected from among Veterans Administration employees and veterans hospitalized for minor physical complaints. The groups were equated for age, education, and intellectual level.

Each subject was given two stimulus patterns of seven adjectives each, the patterns differing only in that one included the word "warm" and the other the word "cold." The subject's free response to each pattern was recorded and his impressions were quantified by his selection from a checklist of antonyms, synonyms, and neutral words. An inquiry into the forming of the impression was included in the procedure.

Treatment of the data was based on scoring of the word selection for identity of words used to describe both patterns and for antonyms to the patterns, and on judgments of the free responses for warmth of the person described, subjects' attitudes of like-dislike, integration of response, and interpenetration of personal themes. Statistical treatment was mainly by rank order methods.

It was found that the schizophrenics tended to reject any implied differences in personal warmth and minimized differences in their own feelings of affection for persons described to them. The experimental sample used more of the same adjectives to describe persons whose difference was one of personal warmth than the control group did and, in responding freely to such contrasting stimulus patterns, the experimental sample expressed the difference in warmth less and responded with less difference in liking for the persons described. The data suggested that this minimization was not a simple neglect of the variable of warmth, representing some basic atrophy of feeling or insensitivity to variation in environmental structure, but a question of selective avoidance. The experimental

sample's tendency to retain initial impressions appeared to have a consistent bias toward warm responses, which was taken to imply an extreme tendency to adopt a congenial initial set, rather than an inability to alter initial set. Findings with respect to ability to integrate discrete elements of a description were inconclusive. The experimental sample imposed private preoccupations on the stimuli to a markedly greater degree. In general the schizophrenic groups differed not only from the control group but from each other with respect to these questions.

Microfilm copy of complete manuscript of 125 pages, \$1.56. Enlargements 6" x 8", 10¢ per page.

#### THE RELATIONSHIP OF CERTAIN PERSONALITY FACTORS TO PROGNOSIS IN PSYCHOTHERAPY

(Publication No. 3626)

Selig Rosenberg, Ph. D.  
New York University, 1952

The purpose of this study was to determine first, whether certain personality factors of pre-treatment psychoneurotics were associated with their subsequent improvement or lack of improvement in psychotherapy; and second, how effectively any significant factors which were found could predict the course of psychotherapy.

The subjects for the study were a group of forty white, male, psychoneurotic veterans of World War II, aged 25-35, all of whom had undergone pretreatment psychological testing. Half of this group was definitely improved and the other half definitely unimproved after nine months of individual psychotherapy. The criterion for improvement was the judgment of the individual treatment psychiatrist supplemented by a check sheet which required specific evidence to justify the therapist's judgment.

The total sample population was randomly split into two equal groups, A and B. The A group was used for the investigation of the personality factors. The B group was used to test the efficacy of the conclusions reached from the study of the A group.

The basic materials of the study consisted of the pretreatment protocols of the Wechsler-Bellevue Intelligence Scale, the Rorschach, and the Sentence Completion Test, and rating scales prepared by the investigator for 23 personality factors. Two judges independently utilized the test protocols of the A group to make qualitative judgments which they translated to the rating scales. Those variables which were found to be significantly different in the improved and unimproved cases were used by the judges as a sole guide in making predictions of improvement or unimprovement from the pretreatment test protocols of the B group.

The significant findings from the A group indicated that, as compared with the unimproved cases, the improved cases had higher Wechsler-Bellevue IQ scores, greater productivity, less

rigidity, a greater range of interests, greater emotional depth, more sensitivity, a higher energy level, and less concern with bodily symptoms. Using these factors as prognostic guides, the judges were able to make significantly better than chance predictions of improvement and unimprovement in the B group.

The results established the basic hypothesis that certain personality factors are definitely associated with progress in psychotherapy with neurotics and that it is possible to make accurate prognostic statements if these factors are utilized as a guide. It was also concluded that a general underlying personality factor associated with a favorable prognosis is the greater ability and desire of the patient for emotional participation in therapy. This suggests the advisability of stressing the emotional aspects of the treatment situation. Another conclusion noted that the personality differences which are associated with progress in therapy are those of degree and not of kind. It was also pointed out that the problem of establishing criteria for improvement need not be a major obstacle to meaningful investigations in psychotherapy.

Microfilm copy of complete manuscript of 135 pages, \$1.69. Enlargements 6" x 8", 10¢ per page.

#### AN ANALYSIS OF THE SIGN-GESTALT INTERPRETATION OF BEHAVIOR AT A CHOICE-POINT: STUDIES ON THE ROLE OF EXTRA-MAZE CUES AND THE EFFECTS OF PRE-EXTINCTION IN PLACE AND RESPONSE LEARNING

(Publication No. 3932)

Donald Peter Scharlock, Ph.D.  
University of Buffalo, 1952

##### Section One

A review of the literature on place and response learning has indicated that the current controversy regarding these two types of learning had its historical origins in some of the earlier experimental work on the sensory control of the maze habit. Of special significance in this respect were the early studies designed to evaluate the role of kinesthesia in maze learning. The results of this experimentation suggested to some students the need for an hypothesis of "place" learning. Woodworth was the first to formally recognize the hypothesis which later on acquired rather crucial status in the sign-gestalt theory of learning.

The interest of Professor Tolman and his associates in Woodworth's hypothesis led them to initiate the series of experiments currently referred to as the "California Studies in Spatial Learning." At present, nine studies of this series are reported in the literature and they reflect a general trend of thought on the part of advocates of the spatial learning hypothesis. The first study of the series seemed to demonstrate that some animals could learn "place" in a maze situation where there were marked extra-

maze cues but that some animals might also learn a specific "response." Subsequent studies in the series were devoted to attempts at differentiating between "place" and "response" learning and generally appeared to provide evidence suggesting that both types of learning occurred in the maze situation but that "place" learning was always superior to "response" learning. In the most recently reported study of the series, it was concluded that "response" learning is really based on the acquisition of two conflicting "place" dispositions. Accordingly, maze learning in situations where there are marked extra-maze cues consists primarily in the acquisition of "place" dispositions.

On the other hand, since the first experiment of the California series was reported, twelve studies have appeared which are directly critical of the results reported in the series. In a number of instances the critical studies have been designed to duplicate experimental situations described in the California series. Under these conditions, contradictory results were obtained. In general, the critical studies have emphasized that the results reported in the California series are artifacts of the particular experimental design employed. The basic criticism has been that the California studies fail to demonstrate empirically the unique properties of "place" learning which make it essentially different from the learning involved in any discrimination problem.

##### Section Two

One of the criticisms which has been offered regarding the experimental situations used in the California series is that the findings reported in these studies are related to the fact that extra-maze cues were not adequately controlled. Two experiments were designed to evaluate the role of extramaze cues in place and response learning. It was concluded that "place" and "response" performances do not reflect the effects of two different kinds of learning but, rather, that they both represent solutions of a problem based on the utilization of cues which are primarily kinesthetic in the instance of response performance and primarily visual in the case of place performance. In these experiments it was found that the solution of the problem based on discrimination involving primarily kinesthetic cues tended to be learned most rapidly. Evidence critical of the "sign" function of the extra-maze cue was presented.

##### Section Three

Some recent reports in the literature have presented data relevant to the sign-gestalt theory of extinction. On the basis of this theory, it was presumed that the performance of place animals would extinguish more rapidly than that of response animals if both groups were given a pre-extinction experience in which they were permitted to "pre-ceive" the non-food containing character of the goal-box. The evidence obtained failed to support the presumption. A number of different measures of extinction were taken and an attempt was made



to determine which of these afforded the best criterion for use with the T-maze. An error criterion was suggested as the most adequate. A number of observations regarding the extinction behavior of place and response animals raised some question as to the appropriateness of the concept of "behavior at the choice-point."

Microfilm copy of complete manuscript of 138 pages, \$1.73. Enlargements 6" x 8", 10¢ per page.

#### AN EXPERIMENTAL INVESTIGATION OF THE CONSISTENCY OF STRESS TOLERANCE AND RELATED RORSCHACH FACTORS

(Publication No. 3692)

Murray S. Stopol, Ph. D.  
Columbia University, 1951

1. A major purpose of the present investigation was to determine whether persons respond consistently to the effects of two distinct kinds of stress, designated as mechanical stress and social stress. The relationships of stress tolerance to recovery from the effects of stress, and to the variability of post-stress behavior, were also explored. In addition, an experimental test was made of the power of certain measures derived from the Rorschach to predict the ability of persons to withstand stress.
2. The following hypotheses were formulated:
  - a. Individuals tend to exhibit consistent modes of reaction in their tolerance for different forms of stress.
  - b. The amount of recovery from stress is positively related to the degree of stress tolerance.
  - c. Post-stress variability of performance is inversely related to the degree of stress tolerance.
  - d. The order of presentation of the types of stress will not affect Hypotheses a, b, or c.
  - e. The Rorschach Test is able to differentiate between those individuals more able to tolerate stress and those individuals less able to tolerate stress on the basis of a number of measures.

If Hypothesis a and/or d is not confirmed, the hypotheses will apply to the different forms of stress taken separately.

3. The Rorschach Test and a series of Digit-Symbol Test practice trials were administered to 48 college students during the first session of the experiment. The second session was composed of two periods of three phases each. During the first period in Phase a, each subject was given a number of Digit-Symbol Test trials under optimal conditions. In Phase b, either social or mechanical stress was induced during five of the ten trials. Phase a was a post-stress phase where no stress was induced. The second period began after a 15-minute interval, during which time the Levy Movement Blots were administered. Each subject then went through a procedure similar to that of the first period except that a different form of stress

was induced. At the close of each session, all subjects rated themselves on an anxiety scale. Two types of stress conditions were utilized: (1) Social stress – consisting of a series of admonishing and deprecatory comments strongly implying disapproval of performance, and (2) Mechanical stress – involving a series of bells, a buzzer, and a flashing light which were presented during a Digit-Symbol Test trial.

4. The results of this study lead to the following conclusions:

- a. Tolerance for social stress and tolerance for mechanical stress are independent of each other; no significant relationship exists between them.
- b. The amount of post-stress recovery is positively related to the degree of social and mechanical stress tolerance, especially during the second introduction of stress.
- c. Variability of performance during the post-stress phase is inversely related to the degree of social and mechanical stress tolerance but only during the second introduction of stress.
- d. A cumulative effect of stress is consistently present which results in a greater decrement in performance during the second administration of stress, regardless of its character.
- e. No significant difference exists between the effects of the particular kinds of social and mechanical stress employed in this study if the temporal sequence of presentation of the stresses is controlled.
- f. During the second introduction of stress, stimulus generalization occurs in the form of a tendency to respond in a similar manner to both stimulus conditions of stress and no-stress.
- g. Individuals differ widely in their reactions to experimentally induced social and mechanical stress; the differences become less pronounced as the effects of stress accumulate.
- h. No specific Rorschach measure is significantly related to performance under either social or mechanical stress to be of any value in predicting efficiency of behavior under stress.

Microfilm copy of complete manuscript of 102 pages, \$1.28. Enlargements 6" x 8", 10¢ per page.

#### THE RELATIONSHIP OF PSYCHOTHERAPEUTIC SKILL AND EXPERIENCE TO KNOWLEDGE OF OTHER PEOPLE

(Publication No. 3962)

Norman Dale Sundberg, Ph. D.  
University of Minnesota, 1952

Knowledge of others was defined as ability to predict verbal responses of normal groups. Six tests were developed with the following content to be predicted:

Test X - Frequency of response to 50 MMPI items in general adult and college populations.

Test Y - Male and female preferences on 47 MMPI items among the general adult and college populations.

Test Z - Implied meanings of 38 statements phonographically reproduced.

Test U - Preferences among college students on 13 pairs of cartoons.

Test V - 58 items mostly concerning sex and age preferences on the Strong Vocational Interest Blank.

Test W - College student preferences on 50 Jurgensen Classification Inventory items.

The main student sample consisted of 57 men and 28 women in a beginning psychology course. The psychotherapist sample included 20 clinical psychologists, 13 psychiatrists, 13 psychiatric social workers, and 9 student counselors.

Intercorrelations among the tests in both samples were below .30 and generally insignificant. Test-retest reliabilities for the students on Tests X and Y were rather low (.58 and .46), but Test Z showed high retest reliability (.89). There were no significant sex differences except female students' superiority on Test Z, the interest test, and the combined score for Tests X, Y, Z and V.

The therapist means were significantly higher than the student means on Tests X, Y, Z and V, and the Vocational Interest Test (based on the clinical psychologist key of the Strong). The student means were higher on Tests U and W (significantly, on Test U).

No significant relationships were found between students' composite scores representing over-all knowledge of others and (1) age, (2) interest test scores, (3) a number of self-reports concerning interests and experience related to psychotherapy, (4) individual MMPI scales, and (5) frequency of MMPI codes. There was a slight but questionable suggestion of a positive correlation between composite scores and (a) ACE results (.252), and (b) high school ranks (.342).

Among the therapists there appeared no significant differences among the four professional groups on the tests, except on Test V, on which the clinical psychologists and counselors scored highest, and on the interest test, on which social workers scored highest. There was no significant relationship between composite scores and age, interest test scores, years in clinical work or number of patients seen for psychotherapy. Staff members were not significantly better than trainees.

Seven student counselors were rated by each other and by supervisors as to psychotherapeutic ability. The adequacy of these measures was questioned, but the insignificant and the negative relationships obtained suggest that in higher ranges of knowledge of others, there might not be a direct relationship to psychotherapeutic ability.

Four high-scoring students and four low-scoring

students were placed one at a time in an approximation of a psychotherapeutic session. They interviewed an actor who played the same role of a patient each time. Their performances were rated by 23 student judges, 6 clinical psychologists, and the actor himself. The student-judges' ratings were contrary to those of the psychologists and the actor. Knowledge of others was related (1) significantly and negatively to students' ratings, (2) positively but insignificantly to clinicians' ratings, and (3) positively and significantly to the actor's ratings.

The general conclusion was that these tests, especially Tests X, Y, Z and V, offer a new and promising lead to the study of psychotherapeutic ability. A number of limitations of the study was discussed along with suggestions for further research.

Microfilm copy of complete manuscript of 267 pages, \$3.34. Enlargements 6" x 8", 10¢ per page.

#### VARIATIONS IN SPECTRAL SENSITIVITY WITHIN THE HUMAN FOVEA

(Publication No. 3808)

John Hall Taylor, Ph.D.  
University of Michigan, 1952

The purpose of the present study is to measure spectral sensitivity at each of three locations within the human foveal retina. Sensitivity differences are to be expected on the basis of observed and inferred structural differences within the foveal retina. Histological evidence indicates the presence of a yellow pigment in some portions of the foveal retina which is expected to reduce sensitivity in the short-wave end of the spectrum. In addition, a relative scarcity of hypothetical "blue" receptors in the center of the foveal region is inferred from hue discrimination data which will also reduce sensitivity in the short-wave end of the spectrum. Inference may also be made as to the comparative sensitivity of various portions of the foveal retina on the basis of the entopic plot of the macula, a technique developed by Clerk Maxwell.

Spectral sensitivity was determined at each of three locations by measuring the energy required for the detection of carefully fixated 1 minute circular spots. Eleven wavelengths through the visible spectrum were studied. The stimulus was presented in 0.1 second flashes to the dark-adapted right eye of each of three subjects. The locations were (a) central fovea, (b) 15 and (c) 43 minute horizontal eccentricity in the nasal direction. The chromatic aberration of each of the eyes used was measured, and appropriate correcting lenses employed to minimize blurring of the retinal image. Fixation was maintained by use of bite boards and a fixation pattern was used which matched the wavelength of the stimulus in each case. An estimate of the entopic macular plot of the observers was obtained using the technique of Miles. Spectral



sensitivity thresholds were defined by a total of 24,750 observations. The data were analyzed by the probit method, each experimental point on the psychophysical curves being defined by 50 observations.

The experimental results show considerable differences in spectral sensitivity among the foveal locations explored. Changes in the shapes of the sensitivity curves as a function of retinal location of the stimulus are related to expectations based upon the presence of the macular pigment as well as upon the hypothetical imbalance of receptor populations. Individual differences between observers as measured by the entopic macular plots are reflected in the sensitivity curves.

Microfilm copy of complete manuscript of 61 pages, \$1.00. Enlargements 6" x 8", 10¢ per page.

**A COMPARATIVE STUDY OF THE VOCATIONAL INTERESTS, ASPIRATIONS, AND ACHIEVEMENTS OF SELECTED GROUPS OF VETERAN PSYCHIATRIC PATIENTS**

(Publication No. 3643)

Albert E. Uecker, Ph.D.  
University of Minnesota, 1952

A group of 50 psychoneurotic veterans, 50 paranoid schizophrenic veterans and 50 veteran vocational advisement cases were matched for intelligence and education. The vocational interests of all of these subjects were inventoried by means of the Kuder Preference Record; vocational aspirations and achievements were assessed by means of an occupational questionnaire administered individually as a standardized interview. The occupational status of the subjects' fathers and employed siblings was also ascertained by means of the occupational questionnaire.

It was found that both the psychoneurotic and the paranoid schizophrenic subjects tended to be less interested in mechanical and scientific work than the control subjects. This disinterest in mechanical and scientific work tended to be associated with the greater tendency toward effeminacy in the psychiatric groups that was shown by their significantly higher scoring on the Mf scale of the Minnesota Multiphasic Personality Inventory. The neurotics scored significantly higher on the Muscial scale, and the paranoids scored significantly higher on the Literary and Clerical scales. Subgroups of patients segregated on the basis of either the pattern or the elevation of their MMPI profiles failed to show any consistent patterns of interests, and it was concluded that vocational interests are not closely related to either the nature or the severity of these mental disorders.

Although the paranoid schizophrenic veterans had not attained military ranks or ratings comparable to those attained by the control subjects, no significant differences were found among the three groups

in regard to pre-service or post-service occupational status as rated by the Minnesota Occupational Rating Scales. No significant group trends were found in regard to occupational stability, but it was found that extreme cases of instability occurred more often in the psychiatric cases than among the control subjects. It was concluded that the post-service occupational adjustment of the psychoneurotic and the paranoid schizophrenic subjects was not markedly deviant from that of the control subjects, and this lack of difference was attributed to the equalizing effects of the post-war program of rehabilitation.

In spite of the fact that clear-cut significant differences were not found among the three groups in regard to the occupational status of their respective fathers or siblings, the psychoneurotics tended to aspire higher than the control subjects and beyond their own occupational status. The failure of the study to show similar trends in the paranoid schizophrenic group was ascribed to the effects of shock treatment on the aspirations of this group.

Detailed study of individual cases tended to support Bordin's hypothesis that vocational interests may be significantly related to the degree of identification with the father. However, there was little satisfactory evidence for the hypothesis that vocational maladjustment, in itself, is a sufficient cause for a neurosis or a psychosis.

Microfilm copy of complete manuscript of 106 pages, \$1.33. Enlargements 6" x 8", 10¢ per page.

**STUDIES IN RADIOTELEGRAPHY**

(Publication No. 3925)

Charles David Windle, Ph.D.  
Columbia University, 1952

The dissertation is composed of two sections. Part I is a review of the recent literature on telegraphic code. In this section, attempts to standardize the meanings of terms used in code practice are discussed; the role of various psychological principles are evaluated with respect to training receiving proficiency; the evidence favoring each of the diverse code aptitude tests is presented; the few available investigations of sending performance are reviewed; and several proposals are made regarding innovations in Morse code procedure and usage.

In general it was found that most of the psychological investigations of telegraphy have focused upon the practical problem of facilitating training of code reception. Although many studies have treated a wide range of variables, there has frequently been disagreement in conclusions and there remains a general need for crucial and cross-validating studies. A definitive comparison among the numerous proposed code aptitude tests appears to be one of the most needed investigations. The study of sending performance has remained

neglected despite indications that such information may be of importance for telegraphy.

Part II involves an experimental analysis of Morse code transmission. The problems investigated arose from an early study by Bryan and Harter in which the claim was made that systematic variations in the length of components dependent upon location correlated positively with sending ability, while error variations were inversely correlated. To cross-validate this claim, sending performances of 13 operators were recorded so as to provide visual records. Analyses of variance demonstrated that systematic variations dependent upon location were typical of all operators, of all components, and of both American and international Morse code. From determinations of sending "ability" based upon "natural" speed of transmission, years of experience, and percentage of errors, it was found that not only did these systematic variations fail to be positively correlated with ability as Bryan and Harter had claimed, but that an inverse relationship applied. Error variation also was found inversely related to ability, as Bryan and Harter had reported.

It appeared possible to describe systematic variations by the structural locations of the components within a signal, since the durations of components varied consistently for given individuals according to the type of component preceded and followed. The only general tendency found among operators was for terminal dashes to be relatively long and for initial and dash-following dashes which precede dashes to be relatively short. For other components there was such great diversity that no generalizations were possible. However, several differences between experts and inexperienced operators were found.

A simple test of the role of reinforcement in producing systematic variations was made for one expert operator by comparing the durations of components subdivided according to confusability, but no consistent differences existed.

These results are discussed in relation to Bryan and Harter's description of the role of systematic variations as corresponding to "inflection in speech." Descriptions by Stetson and others regarding the mechanisms of different types of movement seem more applicable to the present findings.

Microfilm copy of complete manuscript of 151 pages, \$1.89. Enlargements 6" x 8", 10¢ per page.

#### CONSISTENCY OF IMMEDIATE AND DELAYED REPORT OF FINANCIAL DATA

(Publication No. 3820)

Stephen Bassett Withey, Ph.D.  
University of Michigan, 1952

This is a study of the discrepancy in report between (a) responses to questions on current financial items - *viz.* income and liquid asset - and (b)

responses obtained nine months and a year later to the same questions.

The problem of consistency in report on surveys is very briefly treated in the literature and virtually no attention is given to factors that influence the degree of consistency obtained.

The samples drawn for this study are representative of the national population and were part of the annual Surveys of Consumer Finances conducted by the Survey Research Center.

The major hypotheses relating to the financial items were that the greatest amount of consistency would be found among those cases in which there had been no change in the item measured between initial interview and reinterview: further, the distortion in recall, found in those cases that experienced a change between the interviews, would be generally in the direction of the experienced change (increase or decrease) and lastly that the amount of distortion would be roughly proportional to the amount of "real" change that occurred.

Two further hypotheses applied to both the financial items and also a few demographic items that were included - *viz.* age, occupation and education. These were that the shorter the time interval between interviews the greater the consistency between reports, and, the more identical the interview and reinterview situations the greater the agreement in report.

The outstanding result of this research is that the bulk of the inconsistency in report can be predicted from principles of learning theory. Distortions of recall, established through laboratory experiments have proved the major factor in predicting distortions in recall in the complex area of a real life situation involving the recall of such personal and emotionally colored experiences as one's income and savings. The major hypotheses, which are fundamentally based on learning theory were all verified. The findings regarding the two further hypotheses were less conclusive though partially substantiated.

The methodological question: "Is it possible to gather information on one interview that would be equivalent to that obtained on three or four interviews separated in time?" - is answered in the negative if one is interested in exact figures. However, if only gross classifications are required the answer is in the affirmative.

A finding that was not predicted was that among those who experienced a reduction in income one half reported an increase when only the recall measure was used. Errors in recall of change in liquid assets were not more biased in the event of increase than that of decrease. That recall of income decline proved to be much less accurate than recall of income increase may possibly be due to the fact that the former, a relatively rare occurrence in 1948, was contrary to the general trend of the community and therefore an event that would be colored by the individual's perception of widespread economic improvement.

There was no evidence of generalized inconsistency in a person's report of several items



involved. Instead of that explanation, the intervening events for a specific item seem to be the major determiners of inconsistency.

Microfilm copy of complete manuscript of 112 pages, \$1.40. Enlargements 6" x 8", 10¢ per page.

## PSYCHOLOGY, PATHOLOGICAL

### SYNDROMES FOUND IN PSYCHIATRIC POPULATION SELECTED FOR CERTAIN MMPI CODE ENDINGS

(Publication No. 3633)

Joel Malcolm Cantor, Ph.D.  
University of Minnesota, 1952

The intent of this research was to ascertain whether MMPI codes ending in Hy or Pd differentiate out from a psychopathological group sub-groups with particular features. The Low Hy and Low Pd groups were obtained by exhaustive search of MMPI code files. A General Abnormal group was obtained by a mechanical sampling of the discharge summary files. In addition to a cross-validating design, control groups were obtained by random sampling patients presenting High Hy, High Pd, or Low Ma codes. Patients were excluded from the final samples if: diagnosis solely neurological, for mental deficiency, or for specific learning defect; race not White; code obtained later than 30 days after admission; validity T-scores higher than ? 61, L 63, F 80, and K 75, or for either electroshock or insulin shock therapies intervening between admission date and testing. The following information was obtained on the remaining patients: age, marital status, religion, socio-economic level, educational level, and Shipley-Hartford Vocabulary Score. These patients were studied by examination of their discharge summaries with a check-list developed empirically from a random sample of discharge summaries. The tallying was done twice to ensure reliability. The check-lists were randomized into basic and cross-validating groups. Overlap was controlled for patients and codes occurring in more than one group. In the case of the General Abnormal group, overlap was controlled for codes obtained within 30 days of admission. Percentage differences for the incidence of check-list features were obtained for the following comparisons: General Abnormal basic and other basic groups, General Abnormal cross-validating and other cross-validating groups, High Hy basic and Low Hy basic, High Hy cross-validating and Low Hy cross-validating, High Pd basic and Low Pd basic, and High Pd cross-validating and Low Pd cross-validating. Percentages over 7 in the same direction for both comparisons were subjected to Chi-Square test.

No differentiating features were found for the

Low Hy group in cross-validating design with the General Abnormal group. However, with groups merged into larger samples, Low Hy group tends to be "schizoid." The High Hy and Low Hy comparison in cross-validating design shows Low Hy to be characterized by "schizoid; diagnosis of Schizophrenia in general and Paranoid type in particular; marital status of Single." The Low Hy symptom sub-group was not differentiated by age, Shipley-Hartford Vocabulary scores, absolute T-scores on Hy and Sc scales, code beginnings, marital status of Single, and F scale T-scores over 70.

Low Pd when compared to the General Abnormal group in cross-validating design tends to be characterized by "abdominal pain; headache; hypochondriacal thinking; no excessive drinking; S-E Level 3; and not going to College." When compared to High Pd in cross-validating design, Low Pd tends to be characterized by "fatigue, weak, tired; pain; gastrointestinal complaint; no excessive drinking; S-E Level 3." Eight "patterns" of features were also found to differentiate the Low Pd group from the General Abnormal group when the above findings were permuted. The Low Pd symptom sub-group was not differentiated by age, vocabulary scores, absolute values of Pd for ten of fifteen features/patterns, code beginnings, absolute T-scores on Hs and Si scales, and F scale T-scores over 70.

Microfilm copy of complete manuscript of 188 pages, \$2.35. Enlargements 6" x 8", 10¢ per page.

### VISIO-VERBAL TEST FOR SCHIZOPHRENIA

(Publication No. 3928)

James Drasgow, Ph.D.  
University of Buffalo, 1952

The primary aim of this research project was to construct and standardize a test that would discriminate schizophrenics. It was felt that if a test could discriminate schizophrenics from the members of the closely related diagnostic groups usually involved in differential diagnosis aimed at differentiating schizophrenics, then the test would be a highly valuable instrument.

The project involved the extension and integration of earlier research which had indicated that the necessary discriminations might be made at a statistically significant level.

After the test items were constructed, they were administered to eight groups totaling 308 subjects. Detailed attention was given to the criteria for including a subject in any one group in order to have well controlled sampling. Particular consideration was given to the mathematico-statistical derivation of an empirical criterion for chronicity in schizophrenia. The control variables for the groups consisted of age, sex, IQ and extent of formal education.

Quantitative analyses of the test responses

indicated that all groups were discriminable at a statistically significant level as a function of two types of errors. Discriminant functions were employed to maximize discrimination when overlap occurred. A maximum probability table was constructed to indicate the diagnostic group to which an individual belonged with maximum probability as a function of the two types of errors. Validity and reliability coefficients indicated that this test compared favorably to other tests in this area. Little relationship was seen between test scores and the control variables. A three year follow-up study suggested that the test might have prognostic properties in addition to its diagnostic values.

Qualitative analyses revealed that most of the test records from schizophrenics could also be qualitatively discriminated. Numerous characteristics of acute and chronic schizophrenics' records with the norms and neurotics as control groups were described. A conceptual hierarchy was empirically established. Particular types of concepts were individually investigated and seen to be related to the conceptual hierarchy and the problem of identical and similar elements. It was found that concepts based on similar elements had statistically significant higher error frequencies than concepts based on identical elements. The temporal order in which concepts were verbalized was seen to be positively related to the ordered arrangement of concepts in the conceptual hierarchy. Qualitative analysis of the responses in the three year follow-up group suggested confirmation of the qualitative discriminators derived from the independent schizophrenic test groups. Throughout the project suggestions were made towards formulating future research problems that might prove fruitful.

Microfilm copy of complete manuscript of 123 pages, \$1.54. Enlargements 6" x 8", 10¢ per page.

#### STIMULUS AMBIGUITY AND PERSONALITY MALADJUSTMENT AS RELATED TO PERCEPTUAL ADEQUACY

(Publication No. 3898)

Mortimer Powell Lawton, Ph. D.  
Columbia University, 1952

This study investigated the roles of stimulus ambiguity and personality maladjustments as factors in the adequacy of perceptual response. It was based on the hypothesis that both increasing ambiguity of stimulus and increasing degree of maladjustment would tend to decrease perceptual adequacy.

#### Procedure

The experimental tool used was a specially devised projective test which contained stimuli of graded ambiguity. The stimuli were 15 black paper cutouts, chosen by a number of judges from 60

original figures to represent three relatively well-separated degrees of ambiguity. Five figures were chosen as least ambiguous, five as moderately ambiguous, and five as most ambiguous. The 15 figures were presented to subjects with instructions to tell the examiner what they looked like.

Three groups of subjects representing an order of severity of pathology were used. A group of 30 neurotics and a group of 30 latent schizophrenics were obtained from a mental hygiene clinic, and a group of 30 hospitalized schizophrenics was obtained from a neuropsychiatric hospital.

A number of response characteristics was chosen to evaluate the adequacy of responses. These were (a) a Form Level rating scale; (b) a Total Pathology rating scale; (c) Structural Peculiarity categories, including Incongruity, Minor Incongruity, and Fabulation; (d) the Content Categories of Mutilation, Aggression, Sex, Infantile Dependence, and Unusual Content.

The writer scored all responses and submitted one-third of the responses to two judges as a reliability check. Form Level, Total Pathology, Incongruity, Fabulation, and Sex were retained, whereas the other categories could not be scored reliably and were consequently discarded.

It was specifically hypothesized that as stimuli became more ambiguous the adequacy of the responses of all groups would decrease and the diversity of content would increase. It was also hypothesized that the more maladjusted groups would give less adequate and more variable responses than the less maladjusted.

#### Results

Form Level and Total Pathology became less adequate as stimuli became more ambiguous and as pathological severity increased. As degree of maladjustment increased, the rate of decline in form adequacy with greater stimulus ambiguity increased. Total Pathology showed no differential rates of decline among clinical groups.

The incidence of Incongruity, Fabulation, and Sex was least for the neurotics, but the schizophrenic groups were not differentiated. There was a tendency for the total group to give more of these responses to the more ambiguous stimuli, but no single clinical group showed this tendency.

The content of percepts became more variable as stimuli became more ambiguous and as maladjustment increased.

#### Conclusions

1. Perceptual adequacy is a function both of stimulus ambiguity and of the state of adjustment of the responding organism. The interplay of these two variables is different for different kinds of perceptual distortion.

2. Variability of content of perceptual response is a function both of the structural clarity of the stimulus and of the state of adjustment of the responding organism.

3. The rate of decrease in form adequacy with increasing ambiguity of stimulus becomes greater with increasing degree of maladjustment.



4. Responses to the most ambiguous stimuli differentiated clinical groups most sharply, with respect to Form Level, while distortions of the least ambiguous stimuli occurred rarely and did not differentiate the groups as well.

5. Neurotics, latent schizophrenics, and hospitalized schizophrenics are differentiated as groups, but not necessarily as individuals, on the basis of Form Level and Total Pathology scores.

6. Neurotics are differentiated from the schizophrenic groups on the Incongruity, Fabulation, and Sex categories, but the latter do not usually give clues as to the severity of the schizophrenic disorder.

7. While the conclusions of this study may be of value in interpreting the Rorschach test, it must be emphasized that since the experimental tool was not the Rorschach itself, translations into Rorschach terms must be made with caution.

Microfilm copy of complete manuscript of 102 pages, \$1.28. Enlargements 6" x 8", 10¢ per page.

#### SOME PSYCHOMETRIC EVALUATIONS OF EPILEPSY

(Publication No. 3951)

Herbert Bernard Malos, Ph.D.  
University of Minnesota, 1952

The present research attempts to isolate psychometric variables which will discriminate between classes of epileptic patients. All subjects are male veterans of WW I or WW II who were patients on the neurology service of the Fort Snelling Veterans Hospital for short term treatment. Tests used are the Wechsler-Bellevue Intelligence Scale (Form II), and the Minnesota Multiphasic Personality Inventory.

##### Phase I

A. Normal-abnormal EEG. - Of a random sample of 144 epileptic patients, only 56 per cent had ever had an abnormal electroencephalographic record, while 44 per cent had only normal records. These two groups showed no significant differences in (1) age, (2) educational level, (3) marital status, (4) occupational status, or (5) frequency of seizure occurrence. The abnormal EEG group had (1) more cases with nocturnal seizures, (2) more cases with grand mal seizures, and (3) an earlier average age of onset. On the psychometric tests, the abnormal EEG group showed a lower mean Hs score on the MMPI, and a higher mean Block Design score on the W-B. Due to the doubtful reliability of the criterion of EEG normality or abnormality, as well as the differences on such variables as nocturnality, seizure type, and age of onset, no attempt was made to discriminate psychometric correlates of EEG patterns.

B. Organic-cryptogenic. - Employing the final diagnosis of the patient's doctor, 33 per cent of our 144 case sample were considered to have organic

etiologies, while 67 per cent were called cryptogenic. These two groups show no significant differences on any of the eight variables enumerated in paragraph A. Psychometrically, the organic group shows higher mean Hy and Ma scores on the MMPI, and lower mean Picture Arrangement and Performance I.Q. scores on the W-B. Since the criterion of organicity seems more reliable, and since other epileptic factors show no differences between these groups, a further attempt will be made to discover psychometric correlates of these variables.

##### Phase II. Epileptic Organics, Non-Epileptic Organics

Seventy-eight pairs of organic cases, one in each pair with epilepsy and one without epilepsy, were matched for age, educational level, location of lesion, type of disease or injury, and Andersen laterality index. Fifty pairs were used as an original sample, and twenty-eight pairs were retained as a cross-validation sample. The non-epileptic group showed a higher mean ranked Information score on the W-B, and higher mean L score on the MMPI. Neither test afforded any psychometric variable or pattern of variables that was able to discriminate satisfactorily between these two types of cases.

##### Phase III. Organic Epileptics, Cryptogenic Epileptics

Eight pairs of epileptic cases, one in each pair with organic etiology and one with unknown etiology, were matched for age, educational level, and Andersen laterality index. Fifty pairs were used as an original sample, and thirty pairs were retained as a cross-validation sample. The cryptogenic group had significantly higher mean scores on Arithmetic, Similarities, Block Design, Digit Symbol, Performance I.Q., and Total Test I.Q. of the W-B. More of the cryptogenic cases have D scores higher than Hs scores on the MMPI. However, neither test afforded any psychometric variable or pattern of variables that would discriminate satisfactorily between these two types of cases.

It is concluded that mean MMPI patterns of all groups would be similar to a general neurotic pattern. Mean W-B patterns resemble those usually described as organic. On this basis, it is felt that epileptic phenomena in general affect these psychometric devices so as to suggest a picture of organic brain deficit with neurotic personality features. The variability of test patterns within groups exceeds that between groups, so that it was not possible to discriminate between these groups by the psychometric devices used.

Numerous suggestions for future research in the study of relationships between epilepsy and psychometrics are offered.

Microfilm copy of complete manuscript of 236 pages, \$2.95. Enlargements 6" x 8", 10¢ per page.

# DIFFERENTIAL EFFECTS OF FOCAL BRAIN DAMAGE ON THE MINNESOTA MULTIPHASIC PERSONALITY INVENTORY

(Publication No. 3901)

Harold L. Williams, Ph. D.  
University of Minnesota, 1951

Few positive conclusions can be drawn from the literature dealing with personality changes associated with lesions in various parts of the brain, partly because few attempts have been made to bring the problem under the control of rigorous, empirical quantification procedures. That the location of the lesion is important, however, apparently has been demonstrated by such studies as that of Andersen in his investigation of the "laterality" dimension, and Friedman in his demonstration that patients with lesions in the parietal and frontal lobes can be discriminated with a personality inventory.

The present study has three major aspects: (a) a cross-validation of Friedman's work; (b) an empirical study of several hypotheses which arise in connection with the data; and (c) an analysis of profile patterns using a statistical method suggested by Hathaway and Meehl.

For the cross-validation, 20 cases of frontal lobe and 20 cases of parietal lobe damage provided by four Minnesota hospitals were used. As a group, they matched Friedman's sample rather well on variables such as age and occupation. Twenty temporal lobe patients were added for certain extensions of the investigation. Although Analysis of Variance yielded significant differences between frontals and parietals on MMPI scales D, Pt, and Sc, the profile differences were not as striking as those observed by Friedman. As he reported, however, parietals were above frontals on most of the scales, and their profiles suggested depression, anxiety and compulsive trends. Frontal patients, although slightly schizoid, appeared more normal. There was a tendency for D (depression) to be low in relation to the rest of their profile. In spite of these modest profile differences, experienced clinicians were able to sort the profiles into their respective categories with considerable success.

The Friedman Parieto-Frontal Scale sorted the cross-validation cases with only 25 per cent error. However, as a methodological problem, item cross-validation was attempted. A modification of Katzell's "Double Cross-validation" produced a valid scale, but its performance was not much better than that of a scale developed by combining the original and cross-validation groups and selecting items which separated the criterion at the 2 per cent level.

Since the mean temporal profile was almost identical to the mean parietal profile, temporal cases were employed for further cross-validation. A final scale obtained by combining the items appearing in the 2 previous cross-validation scales discriminated temporal from frontal cases with 75 per cent accuracy and it was named the "Caudality Scale."

The sliding median technique of profile analysis

(a method suggested by Andersen and Hanvik) when applied to the parietal-frontal problem demonstrated that as the proportion of parietal patients in the sample increased, D (depression) and Pt (psychasthenia) became prominent variables in the profile, while Sc (schizophrenia) moved downward from relatively high rank. In the temporal-frontal sample, although the neurotic scales gained prominence as temporal cases were added, the psychotic scales also maintained high rank.

CC', a score resulting from profile comparison, combined with a statistical method which maximized variance and covariance among the profiles isolated several key profiles which emphasized the profile patterns in the data. The two profile types isolated by this method, when they were used as keys, produced distributions which were significantly correlated with the frontal-parietal criterion.

Several theoretical issues were partially resolved in this investigation:

1. Earlier workers had postulated the existence in the parietal region of an anxiety suppressor area, the destruction of which allegedly brought about intense anxiety and depressive reactions. The fact that temporal patients behave much like parietals on the MMPI indicates that if such an area exists, it is not confined to the parietal region, and suggests that the reactions noted among parietal and temporal cases are secondary to stress imposed by functional loss. This reaction does not usually occur among frontal cases, a finding consonant with previous observations of these patients. Apparently the frontal lobe damaged patient suffers a relative loss of ability to react with anxiety, and self-criticism.

2. A number of observations by neurologists have suggested that high intracranial tension, age of onset of symptoms, size of the lesion, and the rapidity of its development were correlated with severity and acuteness of psychological symptoms. Since scores on the Caudality Scale were not correlated with any of the above variables, the several hypotheses are not supported by the present investigation.

Microfilm copy of complete manuscript of 137 pages, \$1.71. Enlargements 6" x 8", 10¢ per page.

## ZOOLOGY

### MORPHOLOGY, BIONOMICS AND HOST-PARASITE RELATIONS OF PLANORBIDAE (MOLLUSCA: PULMONATA)

(Publication No 3707)

Emile Tadros Adbel-Malek, Ph.D.  
University of Michigan, 1952

Planorbid snails are virtually world-wide in distribution. Both because of their importance in life histories of digenetic trematodes and because of their human and veterinary significance



they have become a suitable field of investigation among malacologists and parasitologists. However, certain aspects, such as anatomy, histology, bionomics and the relation of these snails to their trematode parasites, have not been thoroughly covered in previous works.

A study of the general organization of a planorbid snail indicated that there was not a septum which was supposed to split the snail into completely separate proximal and distal portions. The separation observed by them was merely a membrane which forms the distal boundary of the pulmonary cavity. Some organs of the snail, such as the oesophagus, rectum, and genital tract, are located underneath that membrane and secure continuity within the viscera of the snail.

For comparative morphological studies a large number of uniformly fixed specimens were examined. The genital organs, which usually provide a basis for the classification of orders, families, and genera, were critically examined and compared. The studies on certain genera and species of Planorbidae indicated that several investigators relied too much on slight and insignificant differences in the character of the genitalia as a means for erecting new species and especially as criteria for recognizing new varieties. It was found that considerable variation exists in the genital organs of snails from one locality. Moreover, environmental conditions in lakes, rivers, ponds, swamps, woods pools, etc. may account for certain changes.

The genital organs of two planorbids, *Helisoma trivolvis* Say (Subfamily Helisomatinae) and *Planorbis boissyi* Potiez and Michaud (Subfamily Planorbinae) were examined histologically. The structure of the tissues forming those genital organs was related to their function. Moreover, there were enough differences in the structure of the genital organs of those two snails to indicate that histological details should be used in the field of systematics.

In a study of the bionomics of planorbids wide differences of pH, free carbon dioxide, dissolved oxygen and total alkalinity were reported indicating a remarkable tolerance in this group of snails. In their natural habitat the snails ate "periphyton" which was composed of blue-green and green algae, mosses, protozoans, rotifers and sponge spicules. Some measure of the tolerance of planorbid snails to drought (aestivation) and to cold (hibernation) was undertaken by observing snails in a drained lake and by maintaining specimens in wire cages over winter. Correlations were found between the number of egg-masses deposited and the snail's diet. A diet of lettuce considerably increased egg-laying production of *Planorbis boissyi*; and a wheat cereal diet almost doubled the production of egg-masses laid. It was also demonstrated experimentally that the size of these snails in aquaria was directly related to the volume of water in which they were reared.

General observations on normal uninfected and on parasitized *Helisoma corpulentum* Say, together with a comparison of the effects of parasitism of this species of snail by three species of trematodes were

carried out. No observable external differences in size, behavior, or color, could be detected in non-parasitized specimens when they were compared with others which were infected with any of the following trematodes: *Petasiger chandleri*, *Clinostomum marginatum* or *Uvulifer ambloplitis*. Non-parasitized snails proved to be slightly heavier than parasitized specimens. Parasitism by either one of these three trematodes considerably reduced the number of digestive gland tubules, as well as distorted the cells of the remaining tubules and reduced their stored glycogen. The sporocysts and the rediae of those trematodes were found in sites not previously shown to be infected. The organs damaged differed depending on the specific trematode infection: i.e., rediae of *Petasiger chandleri* or *Clinostomum marginatum* invaded the acini of the ovotestis, while the sporocysts of *Uvulifer ambloplitis* did not invade the acini. Evidently redial stages of some trematode parasites may damage certain organs of the snail more than do the sporocyst stages of other parasites.

Microfilm copy of complete manuscript of 259 pages, \$3.24. Enlargements 6" x 8", 10¢ per page.

**ATRACTOLYTOCESTUS HURONENSIS N. GEN.,  
N. SP., CARYOCESTUS N. GEN. (CESTODA:  
LYTOCESTIDAE) WITH NOTES ON THE BIOLOGY  
OF THE FORMER AND A REVIEW OF THE  
LYTOCESTIDAE**

(Publication No. 3710)

James Douglas Anthony, Ph.D.  
University of Michigan, 1952

A cestode worm found in the carp (*Cyprinus carpio* Linnaeus) proved to be a new member of the family Lytocestidae and the first found in the Western Hemisphere. The other species of the family are distributed throughout the rest of the world.

This new parasite, *Atractolytocestus*, differs from most of the other genera of the family in the possession of post-ovarian vitellaria. A further differentiation was made on the basis of the length of the uterus as compared to the length of the testicular area, and the position of the uterus in respect to the cirrus sac. The ovary was found to be almost entirely in the medullary portion of the worm. The vitelline follicles often extruded for about one third of their volume from the cortical into the medullary parenchyma. Another characteristic structure, a layer of rod-like cells which lies just outside the basement membrane, is described.

Efforts to find the intermediate host by direct examination of aquatic annelids and plankton were fruitless. The analysis of the stomach contents of the final host, the feeding of parasite eggs to invertebrates and the random feeding of suspected intermediate invertebrate hosts to uninfected carp also proved unsuccessful.

During a survey of the literature it was found that Caryophyllaeus japonensis (Yamaguti, 1934) has been used as the type species of the genus Bothrioscolex (Szidat, 1937). The latter author was evidently not aware that Caryophyllaeus japonensis had already been placed in the genus Khawia by Hsü (1935). Bothrioscolex is thus reduced to synonymy with Khawia.

Caryophyllaeus javanicus was adequately described by Bovien (1926). Since it should be placed in the family lytocestidae, instead of the Caryophyllaeidae, and since it differs from the other genera of the Lytocestidae a new genus Caryocestus is erected to contain it. This genus is separated from the other genera by means of a key based on the characters as given for Atractolytocestus. In Caryocestus javanicus the post-ovarian vitellaria is absent, the uterine coils are posterior to the cirrus sac, the scolex is unspecialized and the vitelline follicles are mostly cortical but frequently medullary in position.

Microfilm copy of complete manuscript of 92 pages, \$1.15. Enlargements 6" x 8", 10¢ per page.

#### THE CRANE-FLY GENUS DOLICHOPEZA IN NORTH AMERICA

(Publication No. 3728)

George William Byers, Ph. D.  
University of Michigan, 1952

North American representatives of the genus Dolichopeza (Diptera, Tipulidae) have overlapping ranges, nearly uniform habitat requirements and many close morphological similarities. A study was therefore made of the degrees and kinds of variation in a series of about 8500 flies of this genus to determine how many species make up the North American Dolichopeza fauna. Also, several aspects of external and internal morphology of all the developmental stages were examined, and the life histories of all species were studied.

Of the seventeen forms previously recognized, twelve are retained as valid species: Dolichopeza (Dolichopeza) americana Needham, Dolichopeza (Oropeza) carolus Alexander, D. (O.) dorsalis (Johnson), D. (O.) johnsonella (Alexander), D. (O.) obscura (Johnson), D. (O.) polita (Johnson), D. (O.) sayi (Johnson), D. (O.) similis (Johnson), D. (O.) subalbipes (Johnson), D. (O.) tridenticulata Alexander, D. (O.) venosa (Johnson), and D. (O.) walleyi Alexander. D. (O.) pratti Alexander is a subspecies of polita; D. (O.) subvenosa Alexander is a subspecies of venosa; D. (O.) dakota Alexander is a direct synonym of venosa; and D. (O.) sessilis Alexander and D. (O.) dorsalis rogersi (Alexander) are direct synonyms of dorsalis. One new race of polita is described and named, and one form of uncertain status is described.

Morphological studies include description and detailed illustration of digestive and reproductive systems of the adults and head-capsule, digestive

system and tracheal system of the larvae. New interpretations of larval and pupal segmentation are presented in an attempt to correlate structures in these two stages. Illustrated keys for identification of larvae, pupae, and both sexes of adults are provided. Species discussions include all literature references, original description, kinds and location of types, diagnostic characteristics (illustrated), descriptive comments (emphasis on intra-specific variation), geographical distribution (with map), habitats of adult and larval stages, seasonal distribution of adults, and descriptions of immature stages.

Distribution of the species of Dolichopeza does not accord with Jordan's Law, in that the range of every species broadly overlaps the range of every other species, as many as six species of adults may be taken in extremely close association, the larvae of many species have identical moss habitats, and the seasonal flight periods of all species overlap. However, there is no evidence of formation of hybrids. Neither is there any evidence of inter-species competition. Some isolation may result from habitat distribution and certain morphological differences between species, but isolation is thought to be accomplished primarily through unobservable characteristics of the insects.

The geographic range of the genus appears to follow closely the distribution of eastern and subarctic forests, while seasonal distribution of the species is apparently related to the length of annual frost-free period.

Microfilm copy of complete manuscript of 366 pages, \$4.58. Enlargements 6" x 8", 10¢ per page.

#### THE DIGESTIVE ENZYMES OF ASCARIS LUMBRICOIDES, VAR. SUIS: THEIR PROPERTIES AND DISTRIBUTION IN THE ALIMENTARY CANAL

(Publication No. 3729)

Mary Frances Pitynski Carpenter, Ph. D.  
University of Michigan, 1952

The properties and distribution of the digestive enzymes of Ascaris were studied using enzyme extracts and frozen microtome sections of alimentary canal. The microliter titration methods of Linderström-Lang and Holter were used.

The nematode was found to have an amylase activated by chloride with an optimum at pH 9.3, a maltase with an optimum at pH 8.0, and a proteinase, not activated by cyanide, which had its best activity on casein at pH 6.0.

Peptidase activity was determined using DL-leucylglycine, DL-leucylglycylglycine, DL-glycylglycine, and DL-alanyl-glycine, as substrates. The data indicate that at least four peptidases are present: leucine aminopeptidase, glycylglycine peptidase, alanyl-glycine peptidase, and a general amino tripeptidase. The splitting of leucylglycine was activated by manganese, while that of



leucylglycylglycine was not. The relative activity on leucylglycylglycine was about twice that of leucylglycine. Alanyl-glycine hydrolysis was inhibited by cysteine. The hydrolysis of glycylglycine was activated by cobalt, but inhibited by zinc, manganese, and cysteine.

Tributylin and methyl butyrate were used to determine lipase and esterase activity. The hydrolysis of tributyrin was enhanced by sodium glycocholate. The pH optimum of hydrolysis of both methyl butyrate and tributyrin occurred at 8.0. The relative ability of an enzyme preparation to split tributyrin was two to three times as great as methyl butyrate.

The properties of *Ascaris* amylase, maltase, and proteinase, are different from the corresponding enzymes in the pig. Distribution studies furnish further evidence for the belief that the enzymes studied were those of the nematode and not of the host.

The distribution of amylase, maltase, proteinase, lipase, alanyl-glycine peptidase, and leucine aminopeptidase, was studied. The activity of all these enzymes was optimal in the anterior part of the intestine, but was also measured in other regions. This may be correlated with morphology, since histological evidence seems to indicate that the anterior region of the intestine is more active in secretion than the other parts.

When expressed in comparable units, the relative activities of the digestive enzymes in *Ascaris* are: peptidases > proteinase > maltase > lipase > amylase.

Microfilm copy of complete manuscript of 191 pages, \$2.39. Enlargements 6" x 8", 10¢ per page.

#### GENERA OF THE HYDRACARINA IN MICHIGAN, WITH A REVISION OF THE MICHIGAN ARRENURIDAE

(Publication No. 3738)

David Russell Cook, Ph. D.  
University of Michigan, 1952

Representatives of all 44 genera of hydrachnids now known to occur in Michigan were taken during the present investigation. Two new genera are described, one belonging to the subfamily Thyasinae and the other to the family Arrenuridae. Both genera are known only from a spring in northern Michigan. A key to the known genera of water mites from the state is included, to which short generic diagnoses and habitat preferences are appended. Fifty-nine species belonging to the genus *Arrenurus* are recorded from Michigan, 15 of which are described as new. Keys, distributional maps, and habitat types are given for the Michigan members of this genus.

Studies on the life history of *Arrenurus superior* Marshall revealed that: The host, or at least one of the hosts, is the damsel-fly, *Enallagma carunculatum*

Morse. The percentages of individuals of *Enallagma carunculatum* which were parasitized climbed rapidly near the first of July and then tapered gradually down as the season progressed. As many as 67 larvae may parasitize a single damsel-fly. The eggs are laid in flat, irregular patches. There were 7-128 eggs in a single group and they were usually only one layer thick. The eggs hatched in 9-15 days at room temperature. The larvae attached to the host while the latter is still a naiad. However, the larvae do not feed until the damsel-fly has metamorphosed into an adult. The larvae found a host only by accidentally bumping into it. The larvae of *A. superior* attached to the pleura and articular membranes of the last few abdominal segments. Larvae became engorged during the parasitic stage and some of them enlarged 40 times their original volume. The nymphs are predaceous. The nymphal stage lasted from one to one-and-one-half months in the laboratory but there is reason to believe that the time was shorter under natural conditions. Metamorphosis from nymph to adult required 6-13 days. Males appeared several days before the females. The integument is soft when the mite first emerges, but hardens within a day or two if the animal is allowed to feed. There seems to be only one generation per year and the individuals of this species overwinter as adults.

Microfilm copy of complete manuscript of 217 pages, \$2.71. Enlargements 6" x 8", 10¢ per page.

#### A TAXONOMIC STUDY OF THE AMERICAN REPRESENTATIVES OF THE GENUS *ELAPHE* FITZINGER, WITH PARTICULAR ATTENTION TO THE FORMS OCCURRING IN MEXICO AND CENTRAL AMERICA

(Publication No. 3743)

Herndon Glenn Dowling, Ph. D.  
University of Michigan, 1951

Especially reference is given to the relationships of the American Ratsnakes in this study. Definitions or diagnoses are given for all forms, as well as for the genus, family, and subfamily to which they belong. A key to the forms is included, and the exact methods used in obtaining and recording the data are given.

The snakes of this genus are of moderate to large size, adults ranging from about 700 mm. (body length) in *Elaphe t. triaspis* to more than 1400 mm. in *E. subocularis*. They are found in the forested and plains regions of North America from Ontario to Costa Rica, and from Florida to Baja California.

The name *Elaphis* Bonaparte (1831), which predates *Elaphe* Fitzinger (1833), proves to be a nomen nudum. Other generic names postdate *Elaphe*, and no subgenera are recognized. The recently proposed subgeneric name *Pseudoelaphe* Mertens and Rosenberg is placed in synonymy.

It is indicated that resemblances in scutellation, form, and pattern should not be used as indicators of relationship in non-interbreeding forms, since these characters tend to converge in distantly related species. Thus, the supposed relationship of American to Eurasian forms (including the genotype) is open to question.

It is shown that the American members of the genus fall into three distinct sections on the basis of hemipenial and other characters. There is no indication of a common origin of these sections in this hemisphere, nor have representatives of these sections been identified in the comprehensive and poorly-defined "genus *Elaphe*" of the Old World. The PANTHEROPHIS SECTION contains two sympatric species-groups, herein called the Guttata and Obsoleta groups. The Guttata Group is made up of eight allopatric forms: a monotypic species, *E. vulpina*; a species, *E. guttata* with three subspecies (*E. g. guttata*, *E. g. rosacea*, and *E. g. emoryi*); and another, *E. flavirufa*, with four (*E. f. flavirufa*, *E. f. matudai*, *E. f. yucatanensis*, and *E. f. rodriguezi*). The Obsoleta Group is made up of a single species, *E. obsoleta*, with five subspecies (*E. o. obsoleta*, *E. o. quadrivittata*, *E. o. spiloides*, *E. o. lindheimeri*, and *E. o. bairdi*). The TRIASPIS SECTION contains a single species, *E. triaspis*, with three subspecies, (*E. t. triaspis*, *E. t. mutabilis*, and *E. t. chlorosoma*). The ROSALIAE SECTION contains two allopatric and monotypic species, *E. rosaliae* and *E. subocularis*.

Microfilm copy of complete manuscript of 234 pages, \$2.93. Enlargements 6" x 8", 10¢ per page.

**A COMPARATIVE STUDY OF THE OSTEOLOGY AND MYOLOGY OF THE CRANIAL AND CERVICAL REGIONS OF BLARINA BREVICAUDA KIRTLANDI AND SCALOPUS AQUATICUS MACHRINUS**

(Publication No. 3749)

George Richard Lawrence Gaughran, Ph. D.  
University of Michigan, 1952

The skeletal and muscular elements of the head and neck of the short-tailed shrew, *Blarina brevicauda kirtlandi* and the prairie mole, *Scalopus aquaticus machrinus* are described in detail. The circulatory system was not investigated and the cranial and cervical nerves are considered only in reference to their foramina of exit from the bone and their muscle innervation. Results are based on the study of preserved, skeletal, and cleared and stained specimens of the short-tailed shrew, the prairie mole, the star-nosed mole (*Condylura cristata*), the shrew mole (*Neurotrichus*), the European mole (*Talpa europaea*), and the long-tailed shrew (*Sorex*).

The crania of the short-tailed shrew and the prairie mole are similar in general proportions, that of the prairie mole showing no significant reduction in height as compared to the short-tailed shrew. The dental formula of  $\underline{3}, \underline{1}, \underline{3}, \underline{3}$  was

confirmed for both species. The auditory ossicles are primitive in *Blarina* and *Scalopus*. In *Blarina*, the cranium lacks a zygomatic arcade and has a primitive tympanic annulus rather than an auditory bulla; the dentary has a double articular facet and a new mechanical fulcrum related to modifications in the masticatory muscles; the transverse processes are better developed and more flared laterally, and hypapophyses are present.

In the shrew, the better developed cervical elements of the epaxial musculature and the heavier longus colli and intertransverse muscles and related skeletal structures agree with the greater freedom of its axial movement. In *Scalopus*, the rectus capitis posterior, the longissimus capitis, and the semispinalis capitis muscles operate with more power and are related to movements in eating and burrowing. The digastric muscle is more primitive in structure and the tensor tympani muscle is absent in *Scalopus*. The sternocleidomastoid complex in the mole is a powerful rotator and depressor of the head. Correlated with greater freedom of scapular movement in *Blarina*, the atlantoscapularis anterior and posterior are present and the anterior trapezius is well developed. The new mandibular fulcrum in the shrew increases the strength of the external pterygoid and temporal muscles and decreases the effectiveness of the internal pterygoid and masseter muscles.

The middle ear appears structurally better adapted for sound transmission in *Blarina*, and in both forms the action of the auditory ossicles supports the theory of a mechanical conduction of sound through the middle ear.

The eyes of *Blarina* and *Scalopus* are so poorly developed that vision is probably poor in the shrew and negligible in the mole.

Microfilm copy of complete manuscript of 191 pages, \$2.39. Enlargements 6" x 8", 10¢ per page.

**THE BIRDS ON A SOUTHERN MICHIGAN FARM**  
(Publication No. 3750)

John Lothar George, Ph. D.  
University of Michigan, 1952

This is an ecological study of the birds on a 171-acre dairy farm in southern Michigan throughout the year. The dynamics of the collective bird population were the primary aim, but each individual, species, and habitat group is analyzed separately.

Information for each species was gathered on survival, mortality, spacing, groupings, numbers, habitat, densities, and reproductive increase, from September, 1947, to August, 1950. The observational technique was used. To facilitate recognition of individuals, 1069 birds of 47 species were color-banded on the study area. Individuals were plotted on maps of the area by species. Locations were recorded to the nearest Gunter's chain. Times were



recorded to the nearest minute. The area was covered systematically, at least once a week. Approximately 3500 hours were spent in field observation.

The results are summarized for each of the 135 bird species encountered during the study. Special emphasis is placed on the 45 species that were found nesting on the study area.

Winter populations averaged about 135 birds per 100 acres of total farmland, and were divided into farmstead, field, forest, and general farmland habitat groups. There were fluctuations in species and numbers, but winter home ranges or territories served to stabilize populations of all birds except the roving field species. Winter populations were determined by survival of resident individuals and establishment of home ranges by other individuals during the autumn season. The latter activity was influenced by farming practices, amount of available food, and temperature. Winter populations formed intra- and inter-specific groups, and social organization and association were highly developed. Special adaptations and utilization of specific favorable niches enabled winter species to spend many inactive hours.

The nesting period extended from late January through September. Nesting success averaged about 49 per cent for the field and thicket nesters, and 67 per cent for the tree and cavity nesters. Reproductive increase averaged 195 per cent, ranging from 150 for the tree nesters to 235 for the thicket nesters. Annual survival, as determined by returns of banded adult males, averaged 45 per cent. Fledgling survival during the first year of life was calculated to average 28 per cent. Local populations during the breeding season were dependent upon the survival of the adults and the movement of young adults into the area; the latter movement was concluded to be dependent upon regional fluctuations and local fluctuations in densities, as well as upon habitat change. Territory functioned as an elastic distribution mechanism.

Microfilm copy of complete manuscript of 413 pages, \$5.16. Enlargements 6" x 8", 10¢ per page.

#### THE CENTIPEDS AND MILLIPEDS OF MICHIGAN

(Publication No. 3773)

Bert Marvin Johnson, Ph.D.  
University of Michigan, 1952

Twenty-four species of centipeds, representing eight families and eighteen genera, and thirty-one species of millipeds, representing sixteen families and twenty-six genera, are now known to occur in Michigan. Range data, together with tables and maps of their distribution within the various counties, are discussed for the individual species. These stress autecology and other phases of natural history. Preferences for xeric, mesic, hygric or edificarian habitat niches are indicated. Many species of

centipeds and millipeds are state-wide in their distribution. However, *Nampabius michiganensis* is found to be confined to the Alleghanian Biotic Province, and the following to the Carolinian: *Arenophilus bipuncticeps*, *Linotenia fulva*, *Otocryptops sexspinosus*, *Pokabius bilabiatatus*, *Cleidogona exaspera*, *Spirostrephon lactarium*, *Polydesmus coriaceus*, *Semionellus placidus*, *Zinnaria butlerii*, *Zinnaria proxima*, *Apheloria coriacea*, *Ophiulus pilosus* and *Ptyoiulus pennsylvanicus*. The most abundant and widely distributed species of centipeds were *Lithobius forficatus* and *Nadabius jowensis*, and *Uroblaniulus canadensis* and *Pseudopolydesmus serratus* among the millipeds. Illustrated keys and synonymy of the species are given as well as techniques in collecting, rearing, feeding and preserving these arthropods.

The biology of *Geophilus rubens* is treated in detail. The animals are adaptable to xeric, mesic, and hygric habitats, but the greatest number of egg clutches were found in xeric niches of *Quercus* associations. The clutches were oviposited between June 14 and August 10. The brood site selected by the gravid female is generally a flat, horizontal plane between the bark and xylem of a fallen tree trunk. Here an average of 38 eggs, each 1.02 to 1.10 mm. in diameter are laid. Instinctively the female coils about the clutch and protects her eggs and larvae for a brooding period lasting forty to forty-six days. Eggs hatched in the laboratory within twelve to fourteen days. During the brooding period the female subsists chiefly on a few of her eggs and weak, unresponsive larvae. The first three stadia: peripatoid, foetoid, and adolescent, are described. The larvae leave the brooding site during the adolescent stadium.

A new polydesmoid milliped, *Dixidesmus gausodicrorhachus*, is figured and described. This milliped according to present records is restricted to heavy mixed plantings of *Acer* and *Betula* within the Alleghanian Biotic Province of Michigan. The breeding habits of this polydesmoid are described. The brood chambers, formed by the females thirteen to fifteen days after copulation, are filled on the average with 136 eggs. Each egg measures 0.40 to 0.42 mm. in diameter. Adults were reared from laboratory eggs within 209 to 216 days through eight stadia. Descriptions and duration of each stadium are given.

The copulatory activities of *Spirobolus americanus* are described in detail. The eggs, deposited individually within pseudofecal pellets which are regurgitated and shaped by the female, hatch within six to nine days. The larvae break free of the pseudofecal pellets in the third stadium. Larvae in early stadia molt within excavations made between the disintegrating xylem and the bark of large, hardwood trees. The nine stadia of this species are described.

Microfilm copy of complete manuscript of 488 pages, \$6.10. Enlargements 6" x 8", 10¢ per page.

# THE SNAKE SUBFAMILY DIPSADINAE IN SOUTH AND CENTRAL AMERICA

(Publication No. 3789)

James Arthur Peters, Ph.D.  
University of Michigan, 1952

The purpose of this study has been to correlate, synthesize, and organize the widely scattered knowledge concerning the snakes of the subfamily Dipsadinae, a part of the family Colubridae, and to present the taxonomic and nomenclatorial changes resulting from examination of all available specimens of the group. There has been no summary of all the genera and species concerned since 1896, and the number of known species has doubled since that date. The taxonomy of the group has been in a state of confusion as a result, and this study has been designed to eliminate as much of this confusion as possible.

The arboreal, malacophagous snakes of South and Central America, variously considered to be members of a separate family called the Amblycephalidae, members of a colubrid subfamily called the Dipsadinae, or members of a taxonomically inseparable unit of the Colubridae, are recognized as composing a distinct subfamilial unit in the Colubridae. This subfamily is characterized in its most specialized members by non-divergent pterygoids, loss of the mental groove, compression of the body, enlargement of the vertebral scale row, shortening of the head, extreme specialization of the jaw musculature, hinging of the dentary portion of the mandible, and turning inward of the maxillary. Many of the intermediate stages in the evolution of this specialized type from a more generalized colubrid type have survived, and make impossible a categorical definition of the subfamily. The genus Dipsas includes those species that have developed both arboreal and mollusk-eating habits, and contains the most specialized species of the subfamily. The species of the genus Sibynomorphus possess most of the characters of specialized dentition and toothed bone changes that have accompanied monophagy, but they have not become extremely well adapted for life in trees, and they do not possess compressed bodies and enlarged scales in the vertebral row. The species of the genus Sibon, on the other hand, have become adapted for an arboreal existence, but still possess divergent pterygoids, the mental groove, and other characters lost or changed in the other genera.

The genus Dipsas, which ranges from southern Brazil and Argentina through all of northern South America and Central America to México, contains seven species groups and thirty-five species.

The genus Sibon, which ranges from México through Central America to the extreme northern part of South America, contains nine species.

The genus Sibynomorphus is not discussed in detail in this study.

Nomenclatorial histories for the subfamily and the genera Dipsas and Sibon are presented, as well

as discussions of the evolutionary trends within the genera and between them, variations in taxonomically important characters on all levels of classification, and keys to the genera and to the species of Dipsas and Sibon. Included in the accounts of each species are detailed descriptions and discussions of individual variations, relationships, and zoogeography. The significance and importance of the various adaptive characters developed within the subfamily are pointed out.

Taxonomic changes made in this study include the following (arranged alphabetically by species name concerned): Leptognathus affinis Fischer=Sibon nebulatus (L.); Leptognathus alternans Fischer=Dipsas incerta (Jan); Dipsas annulata (Günther)=Sibon annulata (G.); Dipsas anthracops (Cope)=Sibon anthracops (Cope); Dipsas argus (Cope)=Sibon argus (Cope); Sibynomorphus barbouri Amaral=Dipsas incerta (Jan); Neopareas bicolor Günther=Dipsas bicolor (G.); Leptognathus boliviensis Werner=Dipsas boettgeri (Werner); Coluber bucephala Shaw=Dipsas indica bucephala (Shaw); Sibynomorphus caucanus Rendahl and Vestergren=Dipsas sanctiioannis (Boulenger); Leptognathus (Dipsadomorus) cisticeps Boettger=Dipsas indica cisticoepe (Boettger); Dipsas costaricensis Taylor=Sibon longifrenis (Stejneger); Dipsas dimidiata (Günther)=Sibon dimidiata dimidiata (G.); Sibynomorphus garbei=Dipsas incerta (Jan); Leptognathus (Asthenognathus) grandoculis Müller=Sibon dimidiata grandoculis (Müller); Leptognathus hammondi Boulenger=Dipsas gracilis Boulenger; Dipsas indica Laurenti=Dipsas indica indica Laurenti; Cochliophagus isolepis Müller=Dipsas isolepis (Müller); Tropidodipsas longicaudata Andersson=Dipsas longicaudata (Andersson); Dipsas longifrenis Stejneger=Sibon longifrenis (Stejneger); Dipsas niceforoi Prado=Dipsas pratti (Boulenger); Sibynomorphus nicholsi Dunn=Dipsas variegata nicholsi (Dunn); Leptognathus nigriceps Werner=Dipsas pratti (Boulenger); Dipsas mikanii oreas (Cope)=Dipsas oreas (Cope); Leptognathus palmeri Boulenger=Dipsas latifrontalis (Boulenger); Dipsas mikanii peruanus (Boettger)=Dipsas peruana (Boettger); Leptognathus pictiventris Cope=Sibon annulata (Günther); Heterorhachis poecilolepis Amaral=Dipsas poecilolepis (Amaral); Tropidodipsas polylepis (Boulenger)=Dipsas polylepis (Boulenger); Leptognathus praeornata Werner=Dipsas latifrontalis (Boulenger); Leptognathus robusta Müller=Sibon nebulatus (L.); Sibynomorphus ruthveni Barbour and Dunn=Sibon anthracops (Cope); Dipsas tolimensis Prado=Dipsas pratti (Boulenger); Cochliophagus tornieri Müller=Dipsas tornieri (Müller); Dipsas trinitatis Parker=Dipsas variegata trinitatis Parker; Leptognathus triseriatus Cope=Dipsas pratti (Boulenger); Dipsas variegata (Duméril, Bibron, and Duméril)=Dipsas variegata variegata (D., B., and D.).

Microfilm copy of complete manuscript of 388 pages, \$4.85. Enlargements 6" x 8", 10¢ per page.



AN ANALYSIS OF SOME PHYSICAL FACTORS  
AFFECTING THE LOCAL DISTRIBUTION OF THE  
SHORTTAIL SHREW (*BLARINA BREVICAUDA*  
*KIRTLANDI*) IN NORTHERN LOWER MICHIGAN

(Publication No. 3792)

William Obadiah Pruitt, Jr., Ph.D.  
University of Michigan, 1952

On a series of five study areas in northern Lower Michigan, illustrating the main forest associations and soil types of the region, physical conditions (soil moisture, temperature, freezing, and penetrability) of the environment of *Blarina brevicauda kirtlandi* Bole and Moulthrop were recorded and analyzed for a period of 14 consecutive months. These conditions were measured by means of Thermistors, for which a method of mounting for field use is described, and Bouyoucos plaster blocks.

This analysis shows that the areas called the Burn, Aspens, Pines, Hardwoods, and Bog stand in that relation to one another in a series with increasing stability of soil temperatures. In regard to depth and amount of winter freezing the relation is Burn, Aspens, Pines, Bog, and Hardwoods, in decreasing amounts. This analysis also shows that the Burn, Aspens, Pines, Bog, and Hardwoods stand in that relation to one another as regards year-round presence of available soil moisture.

Quadrat trapping (approximately 4,000 trap-nights) has shown that, at the time of trapping, *Blarina* is not present on the Burn, rarely in the Aspens, occasionally in the Pines, regularly in the Bog, and in great numbers in the Hardwoods. In contrast, *Peromyscus leucopus* is present on all areas, but in almost reverse concentration. *Citellus tridecemlineatus* was found only on the Burn and Aspens, *Napaeozapus insignis* only in the Hardwoods and Bog, and *Sorex cinereus* only in the Bog.

Because of these relationships, it is postulated that in this region *Blarina* has a major center of population in the hardwoods areas (loams), with a minor center in coniferous swamps and bogs (peats, mucks, or wet sands), and is present in the dry sandy uplands only to the extent that winter freezing and excessive summer heat and dryness of the soil allow it. As succession proceeds and changes in the soil and humus environment occur, *Blarina* keeps pace by invading the newly accessible areas.

Microfilm copy of complete manuscript of 133 pages, \$1.66. Enlargements 6" x 8", 10¢ per page.

THE SKIN GLANDS OF VOLES AND  
LEMMINGS (MICROTINAE)

(Publication No. 3794)

Wilbur Brooks Quay, Ph.D.  
University of Michigan, 1952

This is a report on the sebaceous and sudoriferous glands of rodents in the subfamily Microtinae. The essential features of the glands which are included in this study are their: (1) morphology; (2) histochemistry; (3) topographical distribution in different species; (4) enlargement in particular cutaneous areas in certain genera and species; (5) correlations of size with age, sex, and breeding season; (6) taxonomic and evolutionary significance.

The specimens used in this study, which total approximately 1500, include both dried skins and whole animals preserved in various fixatives. The preserved specimens were studied: (1) grossly; (2) microscopically in whole-mounts of skin colored with Oil blue N; (3) histologically in paraffin sections stained by routine methods; and (4) histochemically in frozen sections treated according to fifteen different techniques, most of which concern the lipid content of the glands.

In this investigation it is found that the sebaceous glands are divided into two major categories, namely, those associated with hair, and those not associated with hair during any stage in ontogeny.

The sebaceous glands with hairs are basically paired or bilobed; some are strikingly enlarged in cephalic and posterolateral regions of the skin. The labial and inflexal glands are examples observed in the cephalic region. These appear to be relatively constant taxonomically, sexually, and seasonally. The enlarged glands of the posterolateral region show marked taxonomic, sexual, and seasonal differences. They are localized in particular areas termed here as caudal, rump, hip, and flank. The glandular enlargement in these areas is greatest in old males, a fact which suggests that sebaceous glands in these localized areas are responsive to the male sex hormone, testosterone.

Sebaceous glands not associated with hairs at any time during development, occur only at mucocutaneous junctions and are of three sorts, namely, proctodeal anal glands, preputial glands, and Meibomian (tarsal) glands. Of these, the first two appear, in at least some species, to respond to the male sex hormone, since they are most enlarged in adult, breeding males. The Meibomian glands show an interesting reduction in number within the subfamily, and have variations of taxonomic significance. The reduction in gland number is counterbalanced by increase in the size of the remaining glands, of which the dominant one is a superior extra-palpebral gland, which extends posteriorly along the duct of the exorbital lacrimal gland.

Histochemical studies of the sebaceous and sudoriferous glands of microtines reveal similarities

and differences with respect to the skin glands of other mammals, but the significance of these is still obscure.

General conclusions which are reached in the study are: (1) Sebaceous glands have a ubiquitous distribution in the haired skin of microtines and they are increasingly more specialized morphologically in the more advanced types (*Microti*) within the subfamily, as compared with the primitive types (*Lemmi*) according to the phyletic schemes of some authors. (2) Sudoriferous glands in this subfamily are restricted to the palmar, plantar, and digital pads.

Microfilm copy of complete manuscript of 153 pages, \$1.91. Enlargements 6" x 8", 10¢ per page.

#### THE LAND MAMMALS OF SOUTHERN FLORIDA AND THE UPPER FLORIDA KEYS

(Publication No. 3800)

Albert Schwartz, Ph. D.  
University of Michigan, 1952

The purpose of the present study is to ascertain what mammals occur in southern Florida and on the Upper Keys, and what effect the weather conditions, especially hurricanes and post-hurricane flooding, have upon the distribution and subspeciation of these mammals. The tropical climate and the distance of the southern tip of the Florida Peninsula from the main continental mass are factors which are also considered in regard to the problem of subspeciation and distribution.

A discussion of the area in general, mentioning topography, geology, and the general aspect of the region, is given. Climate and the obvious effects of hurricanes and post-hurricane flooding are discussed briefly. The vegetation is treated in some detail. Lists of plants for the three major habitats recognized (Eastern Pineland Ridge, Narrow Coastal Region, Western Low Swampy Region - the Everglades), and for several subdivisions under these major categories, are given. The views of both Howell and Dice are compared on the problem of the affinities of the area as to life zone and biotic province. A brief history of previous investigations and taxonomic work on the mammals of the area under consideration is mentioned.

The main body of the study deals with detailed discussions of those mammals present in the area. In each case, data are given on distribution, relative abundance, habitat, reproduction, color and variation, predation, and parasitism. Cranial and external measurements and locality records are given. Forty forms are discussed, of which five have previously been described as new as a result of this study. A table correlates the distribution of these forms and their abundance with the habitats mentioned previously in the paper. A list of the mammals and their parasites is also made.

Of the species occurring in southern Florida, 67 per cent show north temperate affinities, 17 per cent are held as endemic, 14 per cent are regarded as of tropical affinities, and the West Indian and pandemic elements each comprise 3 per cent. Twelve other species of mammals occur in the north and central portions of the Peninsula, but are absent in the southern counties. Of these, six are bats, and their absence in the southern area may be accounted for by the effects of the almost annual hurricanes or weather disturbances. Absences of the remaining forms may be accounted for by habits (burrowers with poor powers of dispersal), lack of proper habitat, or small size and boreal affinities.

The mammals of the Upper Keys are discussed in detail. Key Largo is regarded as having the least depauperate fauna, due to its proximity to the mainland. Keys to the north and south of Key Largo have increasingly less variety of species. The negative effects of hurricanes on the key fauna, along with the marine gaps between the keys, coupled with the positive effects of the Overseas Highway are discussed. The Largo fauna may be divided into three major divisions: (1) species which occur on the immediately adjacent mainland and on Key Largo; (2) species on Key Largo and not on the immediately adjacent mainland; (3) species present in southern Florida, but absent on Largo because of intervening inhospitable areas, impassability of intervening marine waters, lack of suitable habitat on Key Largo, and widely separated geographic range.

In conclusion, it appears that subspeciation along the Florida Peninsula is due to extreme localization of some forms, the long peninsulation of Florida, and the tropical climate and severe weather conditions which affect the mammals at its southern tip.

Microfilm copy of complete manuscript of 189 pages, \$2.36. Enlargements 6" x 8", 10¢ per page.

#### THE RELATION OF PHYTOPLANKTON PERIODICITY TO THE NATURE OF THE PHYSICO-CHEMICAL ENVIRONMENT IN CERTAIN MICHIGAN LAKES

(Publication No. 3810)

Allan Tucker, Ph. D.  
University of Michigan, 1952

This investigation was undertaken in an attempt to discover relationships which may exist between the seasonal and vertical distribution of phytoplankton in five Michigan lakes. Plankton samples and physico-chemical data were collected from Douglas Lake in northern Michigan during the summer of 1948 and during 16 consecutive months from July 3, 1950 to October 6, 1951. In addition similar data were collected during the summers of 1948, 1950 and 1951 from



Munro, Vincent and Lancaster Lakes in northern Michigan and during the fall of 1950 from Lake Lansing in southern Michigan. Morphometric data are presented for each of the lakes. The genera of phytoplankton were counted and their seasonal variation, vertical distribution and percentage composition tabulated and illustrated by means of graphs. The dominant class of algae in Douglas Lake at all times was the Bacillariophyceae. In Lancaster Lake, Chrysophyceae contributed the largest percentage of phytoplankters to the summer crops. Cyanophyceae was the important group in both Munro and Vincent Lakes during the summer. Bacillariophyceae constituted the largest part of the phytoplankton population in Lake Lansing during the fall of 1950. No clear cut correlations could be established between variations of phytoplankton numbers and changes in the chemical factors of the environment. During the 16-month period of investigation in Douglas Lake, three major phytoplankton pulses occurred, one after the inception of each overturn. Although the concentration of soluble inorganic phosphorus in the epilimnial waters varied between zero and 6 micrograms per liter, no correlation could be found between changes in the phosphorus content of the water and quantitative variations in the populations of phytoplankton.

An interesting phenomenon was observed in respect to the release of phosphorus in the bottom waters. During thermal stratification and several weeks after the oxygen had disappeared from the bottom of the hypolimnion, phosphorus was released from the mud and diffused upwards about one meter. Evidently under aerated conditions, the phosphorus is bound with iron as insoluble ferric phosphate, but when oxygen disappears from the bottom waters, the ferric phosphate changes to soluble ferrous phosphate and is released from the mud to the water. When the overturns occur, this phosphorus is distributed throughout the whole lake and is available to the phytoplankton. The phytoplankton pulses begin to occur almost immediately after each overturn. There is no evidence in this study that phosphorus brought to the surface waters from the bottom of the lake has any controlling influence over the reproductive rate of phytoplankters in Douglas Lake probably because there is always a sufficient minimum present. It is suggested that other nutrient elements such as silicates which are combined with the ferric complexes and released at approximately the same times of the year as phosphorus, are responsible for the phytoplankton pulses occurring after each overturn. It is a hypothesis of the author that the magnitude and duration of each of the phytoplankton pulses which occur after an overturn may depend upon the magnitude and duration of nutrient liberation from the mud which, in turn, depends upon how long before the overturn, the bottom becomes depleted of oxygen.

Microfilm copy of complete manuscript of 261 pages, \$3.26. Enlargements 6" x 8", 10¢ per page.

# THE INFLUENCE OF DIFFERENT NUMBERS OF INSECTS ON MORTALITY PRODUCED BY INSECTICIDES, AS SHOWN WITH *TRIBOLIUM* SPP., AND *AEDES AEGYPTI* L.

(Publication No. 3965)

Bansi Lal Wattal, Ph. D.  
University of Minnesota, 1952

The influence of different numbers of insects on mortality produced by an insecticide DDT, was studied with fourth instar larvae of *Aedes aegypti*; and the adults of *Tribolium* spp., with DDT and pyrethrins.

Mosquito larvae were treated with DDT-acetone-distilled water suspension in beakers except in one test when the DDT suspension was renewed every half hour. In this test larvae were confined in small tubes open at both ends but having bolting cloth fastened to the bottom. These tubes were immersed in the suspension in beakers without submerging the tubes. Additional tests involved using antibiotics with the suspension to study the effects of DDT on larvae with and without microorganisms.

Flour beetles were confined on filter papers impregnated with DDT and pyrethrins solutions in petri dishes. Most of the experiments were carried out in covered petri dishes. However, some experiments were carried out in petri dishes without covers, and with covers containing some activated carbon. Movies were taken to study the activity of insects on treated and untreated surfaces. *Tribolium confusum* was dusted on filter papers in petri dishes and also put on dusted filter papers. DDT and pyrethrins dusts were applied by a precision vacuum method.

The results showed that mosquito larvae used in different numbers subjected to the same concentrations and volumes of DDT suspensions had lower mortality at higher numbers. This mortality appeared to be controlled by the amount of DDT available per larva because an increase in the amount of DDT available to each larva had a levelling effect on the mortality differences at different numbers. Also, greater mortality with fewer larvae was evident when the amount of DDT was increased by using larger volumes of a suspension. However, the same amount of DDT in dispersion produced lower toxicity to larvae at all levels with an increase in the volume of the suspension presumably because limited movement of the larvae prevented them from contacting all the DDT. The pH of DDT suspension did not change significantly during the experiment at different larval densities. The possible effect of microorganisms in lowering the mortality at higher numbers of larvae has been considered but their influence is not clear.

The per cent mortality of adults of *Tribolium confusum* and *T. castaneum* was greater with higher numbers than with lower numbers when they were exposed to DDT and pyrethrins solutions on filter papers, provided the tests were carried out in petri dishes with covers. *T. confusum* dusted with pyrethrins gave similar mortality relationships.

However, there was no difference in mortality with different numbers used when *T. confusum* was exposed in uncovered petri dishes or in the presence of activated carbon used with covers. A motion picture study of *T. confusum* showed that these insects had a higher rate of movement when larger numbers were exposed on treated surfaces whereas there was no significant difference in the rate of movement when insects were exposed on untreated surfaces. The insects moved more rapidly on untreated surfaces at all levels of insect densities than on treated surfaces. Greater numbers of insects on the treated surfaces produce a greater chemical secretion (earlier workers class this

chemical as an ethyl quinone). This volatile secretion is accompanied by increased mortality in closed dishes. The increased movement of the insects may increase the pick-up of the insecticide resulting in higher mortality. Just how increased movement, increased secretion and increased numbers are related in terms of cause and effect is not clear. Probably the increased movement and increased secretion are both influential in producing a higher per cent mortality with larger numbers of insects.

Microfilm copy of complete manuscript of 110 pages, \$1.38. Enlargements 6" x 8", 10¢ per page.

## EARTH SCIENCES

### GEOGRAPHY

#### THE INTRODUCTION OF FLUE-CURED TOBACCO AS A COMMERCIAL CROP IN NORFOLK COUNTY, ONTARIO

(Publication No. 3757)

Robert Burnett Hall, Jr., Ph.D.  
University of Michigan, 1952

Norfolk County in southern Ontario is now one of the richest agricultural areas in Canada. In sharp contrast to the present prosperity, a large part of the county was considered a marginal farming area twenty-five years ago. Farm abandonment was common and the population dropped from 33,000 in 1881 to 26,000 in 1921. The purpose of this study is to show how the introduction of a single cash crop, flue-cured tobacco, changed this declining agricultural area into one of expanding population and prosperity.

Chapters I and II are presented to show the very rapid development of tobacco growing in Norfolk, following its successful introduction in the 1920's. The light, sandy soils of the county, which are poor for general agriculture, were found to be ideally suited for flue-cured tobacco, and the area quickly developed into the leading producer in Canada. Norfolk and small parts of surrounding counties now produce over 100,000,000 pounds of tobacco annually, with a total farm value of \$50,000,000.

Chapter III presents the operation of a tobacco farm in Norfolk County. It shows how specialized farm practices and equipment are employed to grow and harvest the valuable tobacco crop. The material for this section was gathered through field studies and personal interviews.

Chapter IV shows the striking increase in land values in the tobacco belt. County assessment records and land sales demonstrate that tobacco farm values have increased four and five fold in the past twenty-five years. In contrast to this increase, the value of general farms in Norfolk has remained at

about the same level or has increased only slightly during this period.

Finally, Chapter V presents the changes in the numbers and composition of the population of Norfolk. Two striking changes have occurred since tobacco has become a commercial crop: a) the population of the county has increased from 26,000 in 1921 to about 40,000 in 1950, and b) a great many immigrants from northern and central Europe have come into the county to grow tobacco. The long, hard hours required to grow tobacco didn't generally appeal to the inhabitants, and many Belgian and Hungarian immigrants came in to fill the need for labor. These people have generally been successful and many now own farms. This influx of "New Canadians" into an area which was predominantly of Angle-Saxon ancestry has created some temporary problems of social adjustment.

In conclusion, the introduction of tobacco, a high value cash crop which is especially well-adapted to the sandy, infertile soils of the county, has brought great prosperity to Norfolk. The kind of labor necessary to raise tobacco has drawn in many people with different cultural backgrounds from that of the original settlers. However, the assimilation of the new groups is progressing quite rapidly, especially in the second and third generations.

Microfilm copy of complete manuscript of 113 pages, \$1.41. Enlargements 6" x 8", 10¢ per page.

#### THE SETTLEMENT OF THE BLACK SWAMP OF NORTHWESTERN OHIO

(Publication No. 3775)

Martin Richard Kaatz, Ph.D.  
University of Michigan, 1952

Northwestern Ohio, particularly that portion once covered by the Black Swamp, stands out in the early



annals of the "westward movement" because it was very slow to be settled. Lands to the north, south, and west were settled first. Why was northwestern Ohio avoided? How was it finally settled? How was the landscape transformed so that it became an integral and prosperous section of the Corn Belt? These are the principal problems and questions with which this study of the historical geography of the Black Swamp is concerned.

Of necessity historical materials play a prominent part in the reconstruction of the past landscape and the events which transpired upon it. Library research has been combined with field investigations to determine the former limits of the Black Swamp and the extent of its transformation.

Basic to analysis of the settlement of the Black Swamp has been the construction of a series of maps showing, by isopleths, the density of population decade by decade. These maps are based on statistics by townships.

Following the removal of the Indian from northwestern Ohio, settlers began to penetrate the region; but the white man, like the Indian before him, settled almost exclusively on the margins of the swamp along the Maumee and Sandusky Rivers. The Indian paths which fringed the swamp became the roads of the white man. Most settlers avoided the Black Swamp, preferring to take up lands further west or in southeastern Michigan. The population of the latter region exceeded that of northwestern Ohio throughout the period covered by this study.

It was only after the development of systematic drainage projects together with the construction of numerous railroads that the interior of the Black Swamp began to be settled. The northern portion lying along the main east-west route was settled first.

Black Swamp settlement entered the climax stage ca. 1890. By the 1890's northwestern Ohio was almost fully occupied, and what once had been swamp was becoming a fertile and productive section of the Corn Belt. Modern agricultural statistics reveal that the tract of land formerly occupied by the Black Swamp is now the most completely cropped area in Ohio. The land is criss-crossed with railroads and highways where once only Indian trails breached the wilderness; yet the major settlements still persist on the periphery of the former swamp.

This study shows that, once established, the initial pattern of settlement has tended to persist in a region formerly characterized by unfavorable terrain conditions, although these unfavorable conditions have long since been removed.

Microfilm copy of complete manuscript of 166 pages, \$2.08. Enlargements 6" x 8", 10¢ per page.

## PRESENT AND FUTURE SETTLEMENT IN THE HEARST-NIPIGON REGION

(Publication No. 3822)

James Frederick Woodruff, Ph.D.  
University of Michigan, 1952

A population distribution map of Canada indicates that north of Lake Superior there is a wedge of settlement extending westward along the railroad from the Timiskaming Lowland to the Hearst area, while northeast from the Fort William area there is another prong of settlement extending to the Nipigon River. Scattered across the intervening wilderness are a number of isolated pockets of population. The continuously settled bands which terminate at Hearst and Nipigon seem to be a part of a twofold frontier movement which will eventually join to form a solidly settled area north of the Lake Superior shore. To determine whether this is the case or whether the pattern of settlement has stagnated and become hardened it is necessary to examine the basis for settlement at its present stage and evaluate the natural resources in terms of their ability to support a continued advance of the frontier.

The area between Hearst and Nipigon first became important during the days of early French fur trade and the struggle between the English and French for dominance of this trade. Today the region has little significance as a source of furs and this activity does not support any appreciable population.

The greatest basis for population in the Hearst-Nipigon region is the pulp and paper industry. The area is almost entirely within the limits of three concerns whose mills are on the shore of Lake Superior and which give employment to about 1,500 to 2,000 men. To supply these mills with pulpwood an additional 3,000 to 5,000 men are working in the bush. The possibility of increasing this labor force would necessitate a change to a more efficient use of the forest and to a permanently settled forest colony type of woodland bush worker. Such a change is unlikely to take place, although the Swedish forest industry has proven its desirability. The improvements in bush camps, company towns, and year-around work schedules are attempts by the companies to attract a more desirable and permanent type of worker. An increase in the labor force by these means will, however, retard agricultural settlement for it will deprive farmers of their supplemental work in the bush during the winter.

The pattern of agricultural settlement in the Hearst-Nipigon region will change little, since climate, soil, and markets are against the development of successful farming. The expansion of the present subsistence marginal farms will continue to move west from Hearst and will eventually fill the remaining uncleared clay plain soils. With the disappearance of these soils to the west, the increasingly severe climate to the south, and muskeg conditions to the north, agriculture will give way to forestry as the dominant land use. The greatest change in present land use will accompany the growing recreation and tourist business. This will be largely confined to the

Lake Superior shore because of the nature of the northern landscape and will not reach its ultimate increase until the present Schreiber road is extended to Sault Sainte Marie.

Gold mining, while it accounts for the settlement in the Geraldton area, cannot be expected to support any increase in population, nor can the railroad which has produced Schreiber, the only other town not accounted for by agriculture or the forest.

In the final analysis the pattern of settlement in the Hearst-Nipigon region will, barring unforeseen population pressures in the future, show only minor changes and modifications, and the area as a whole will remain principally devoted to a forest land use.

Microfilm copy of complete manuscript of 158 pages, \$1.98. Enlargements 6" x 8", 10¢ per page.

## GEOLOGY

### PALEOCENE AND EARLY EOCENE STRATIGRAPHY AND VERTEBRATE PALEONTOLOGY OF THE HOBACK BASIN, CENTRAL WESTERN WYOMING

(Publication No. 3742)

John Adam Dorr, Jr., Ph.D.  
University of Michigan, 1951

Several episodes of Laramide deformation have been recognized in the Hoback and Gros Ventre ranges bordering the Hoback basin. One major episode is more closely dated by the paleontologic and stratigraphic evidence presented in this study. Fossil vertebrates from several localities are described and recent interpretations of the geologic structure of the area are reviewed. The Hoback formation and Pass Peak conglomerate are described and their age, origin, and structural relationships are discussed.

The earliest Laramide deformation probably began west of the basin, the resultant uplift providing part of the sediment for the Hoback basin. The Hoback formation was overridden on the west by thrusting in the Hoback Range. This thrusting occurred sometime after the beginning of the Eocene, probably in post-Wasatchian time. The Pass Peak conglomerate subsequently overlapped this thrust, then was involved itself in later faulting in the Gros Ventre Range.

The Hoback formation is described as consisting of 15,000 ± feet of alternating, drab, carbonaceous shales, and arkosic sandstones, with several argillaceous, freshwater limestones, and a few thin coal seams. The sandstones are generally irregularly bedded and lensing, and the bedding in the shales is generally poorly developed. A type locality is designated for the formation, six stratigraphic sections are described, and a number of fossil localities are listed. The angularity of the sandstone grains, particularly the quartz grains, precludes reworked local

Paleozoic and Mesozoic formations as the sole sediment source and suggests an early local pre-Cambrian exposure. The presence of coal, carbonaceous shale, and abundant plant fragments, the generally drab-color of the beds and the irregular nature of the bedding, indicate fluvial deposition under heavily forested, humid, lowland floodplain conditions. An early Tiffanian arboreal and forest mammalian faunule discovered 9,000 ± feet above the lowermost exposures of the Hoback formation supports this conclusion and indicates that the lower two-thirds of the formation are Paleocene in age. The fossil vertebrates of this quarry faunule are described and a new species is erected in each of the following mammalian genera: *Ptilodus*?, *Plesiadapis*, *Carpodaptes*, *Didymictis*, and *Haplaletes*.

The occurrence of *Coryphodon* and *Probathyopsis* successor? is reported, and the material described, from a still higher horizon. It is concluded that the Hoback formation is partly equivalent in age to the Almy formation but that it resembles Paleocene-earliest Eocene deposits in the Jackson Hole area more closely lithologically.

Over 1500 feet of Pass Peak conglomerates, unconformably overlies the Hoback formation. These beds cannot be dated with certainty yet, but may be middle Eocene in age, or younger.

Microfilm copy of complete manuscript of 166 pages, \$2.08. Enlargements 6" x 8", 10¢ per page.

### STRATIGRAPHY AND PALAEOONTOLOGY OF THE BANFF AND ASSOCIATED CARBONIFEROUS FORMATIONS OF WESTERN CANADA

(Publication No. 3759)

Peter Harker, Ph.D.  
University of Michigan, 1951

This study is the first of several reports describing the stratigraphy and palaeontology of the Carboniferous formations of western Canada for the Geological Survey of Canada. The field investigations on which the work is based were made in the Alberta Rocky Mountains, between Banff and Jasper, and included a study of the Exshaw, Banff, Rundle and Rocky Mountain formations. The last three formations have type sections in this region.

The Carboniferous rocks of the area were studied by Kindle, Shimer and Warren, most of whose views regarding the classification and correlation of these strata are in agreement with those of the author.

The Exshaw formation consists of black shales and silt-stones and overlies the massive Devonian Palliser limestone. The Exshaw is lithologically related to the overlying Banff formation but the palaeontological evidence indicates that it is of Devonian age.



The Banff consists of argillaceous limestones and shales of Mississippian age corresponding lithologically with the Lodgepole formation of Montana.

The Rundle conformably overlies the Banff and consists of a thick sequence of limestones and dolomitic limestones. In the Banff region the Rundle is divisible into a lower member consisting of massive crinoidal limestones and dolomitic limestones, and an upper, less massive member, composed of limestones, cherty limestones and dolomites. The Rundle is correlated with the Mission Canyon and higher Mississippian formations of Montana.

The Rocky Mountain formation consists of sandstones, sandy dolomites, dolomites, and bedded cherts and shows considerable lateral variation in lithology. Faunal evidence suggests that the formation is Pennsylvanian; the upper part of the formation may be Permian.

Most of the fossils of the Banff formation are brachiopods, which are closely related to species found in Mississippian strata of the Mississippi Valley states. New species of a *Dictyoclostus*, a *Bembexia* and an *Agelacrinites* are described.

Study of the fossils indicates that the formation contains two distinct faunas, both of which exist in the Banff strata of the Banff region. In the Jasper region, only the lower fauna is present in the Banff strata; a few specimens of a coral found in the lower part of the Rundle formation of this area are related to a species in the higher fauna of the Banff formation in the Banff region. This occurrence suggests that the lower part of the Rundle at Jasper may have the same age as the upper part of the Banff formation at Banff.

Identification of the fossils of the two Banff faunas indicate a correlation of the Banff strata with the Kinderhook and Osage deposits of the Mississippi Valley region.

Microfilm copy of complete manuscript of 208 pages, \$2.60. Enlargements 6" x 8", 10¢ per page.

#### THE DEVONIAN STRATIGRAPHY AND CORRELATION OF THE ALBERTA ROCKY MOUNTAINS WITH DESCRIPTIONS OF THE BRACHIOPOD FAMILY RHYNCHONELLIDAE

(Publication No. 3785)

Digby Johns McLaren, Ph.D.  
University of Michigan, 1951

The work is the first report of a series designed to describe the stratigraphy and palaeontology of the Devonian of the Alberta Rocky Mountains for the Geological Survey of Canada. Previous work in the region is discussed and the formational nomenclature employed in the present work defined. The succession consists largely of dolomites and limestones with some black or green shales and some siltstones, and lies entirely within the Upper Devonian with the

exception of the Ghost River formation at the base. This formation which is unfossiliferous may be Cambrian or Devonian, its upper and lower contacts being apparently gradational. The formations, in the vicinity of Jasper, include, from oldest to youngest: the Flume, Perdrix, Mount Hawk, Alexo, and Palliser. The Flume is divided into a lower and an upper member, and the Palliser into the Morro and Costigan members. Near Banff the lower part of the succession is included in the Fairholme formation, the lower member of which is correlated with the Flume and Perdrix formations of Jasper, and the upper member with the Mount Hawk. The Alexo and Palliser formations are recognizable over the whole region. Overlying the Palliser, the thin black shale of the Exshaw of doubtful Devonian age is everywhere present and appears to grade upwards into the Banff formation of Mississippian age. The fauna and ecology of each formation is discussed and correlation with other regions in North America considered.

The second part of the work begins with definitions of the terms used in the descriptive palaeontology to designate the external and internal characters of rhynchonellid shells. A method of examining and illustrating their internal structure is discussed. Species belonging to the genera *Camarotoechia* Hall and Clarke and *Leiorhynchus* Hall are described. The external and internal structures are discussed in detail, the latter being illustrated by series of camera lucida drawings of transverse sections of selected shells. The range of variation of each species is considered as far as the size of the collections allow, and each is illustrated by a series of photographs which demonstrate, as far as possible, ontogenetic changes as well as adult variation. Where possible attention has been given to problems of speciation in fossil populations and an attempt has been made to distinguish between geographical or ecological and chronological subspecies.

Microfilm copy of complete manuscript of 215 pages, \$2.69. Enlargements 6" x 8", 10¢ per page.

#### GEOCHEMICAL PROSPECTING APPLIED TO THE ILLINOIS-KENTUCKY FLUORSPAR AREA

(Publication No. 3853)

Matthew Peter Nackowski, Ph.D.  
University of Missouri, 1952

The applicability of geochemical methods of prospecting for fluor spar in the Illinois-Kentucky fluor spar area was investigated. Because a thick soil cover over the bedrock limits direct geological methods of prospecting, to date, churn drilling and diamond drilling principally have been used to explore favorable areas. A possible method is geochemical prospecting, which utilizes the varying concentrations of elements, known as "indicators", which to be of optimum value must occur in media near the surface that

can be sampled systematically, be spatially related to fluorspar deposits, and be subject to rapid analysis.

Soil near bedrock was chosen as the best medium for sample analysis. Samples were analyzed for selected indicator elements, fluorine, vanadium, barium, strontium, and the heavy metals, copper, lead, and zinc, which were determined together as zinc equivalent. Barium, strontium, and vanadium were analyzed spectrographically; fluorine, volumetrically; and the heavy metal as zinc equivalent by a non-specific dithizone procedure.

Three areas were sampled in the search for geochemical dispersion halos. Areas No. 1 and 2 in Hardin County, Illinois, are underlain by bedding replacement deposits which are from 150 feet to 450 feet below the surface. Dispersion halos in these two areas are buried by loessal soil, are secondary, and were expected to be diffuse, interrupted, and difficult to distinguish from the normal elemental content of the soil. Area No. 3 is along the Babb fault system in Crittenden County, Kentucky, and the nearly vertical fractures containing the vein deposits reach the bedrock surface. The dispersion halos in this area are also buried, are secondary, and were expected to be more intensely developed than the halos over the bedding replacement deposits.

In Areas No. 1 and 2, the fluorine content of the soil fraction less than .75 millimeters in diameter ranged from 0.017 per cent to 0.051 per cent. The mean was about 0.034 per cent fluorine, and the positive anomalies were only about 21 per cent higher than the mean. In Area No. 3, the fluorine content ranged from 0.034 per cent to 0.140 per cent. The mean was about 0.065 per cent and the positively anomalous concentrations were about 54 per cent higher than the mean.

The vanadium concentrations and anomalies were similar in the three sample areas. The vanadium content ranged from 0.003 to 0.02 per cent, and the mean was about 0.005 per cent. It is suggested that the anomalies represent vanadium which was immobilized as a fluo-vanadate, and was not a constituent derived from the mineral zones.

In area No. 3, barium and strontium showed positive anomalies which were related partly to the traces of vein fractures. No dispersion halos were recognized in Areas No. 1 and 2. These elements were derived from the mineralized zones where they occur as components of gangue minerals.

The heavy metal analyses for copper, lead, and zinc, determined as zinc equivalent, ranged from nil to 100 parts per million. The normal content in Areas No. 1 and 2 was 12 parts per million; higher values were considered positively anomalous.

Of the elements used as indicators, the heavy metals, copper, lead, and zinc, show the most promise as indicators of mineralization. The fluorine is technically unsuited as an indicator element.

Microfilm copy of complete manuscript of 144 pages, \$1.80. Enlargements 6" x 8", 10¢ per page.

## THE PALEONTOLOGY OF THE CHESTER SERIES OF SOUTHWESTERN MISSOURI

(Publication No. 3867)

Leo Milford Wright, Ph.D.  
University of Missouri, 1952

The study of the systematic paleontology of the Chesterian formations of southwestern Missouri has revealed important information concerning the age relationships of the Mississippian formations of the Middle West. The detailed faunal studies of this work indicate that the Hindsville fauna of southwestern Missouri is equivalent to the Ste. Genevieve fauna of Illinois. The age of the Ste. Genevieve fauna is debatable and has been referred to both the Meramecian and Chesterian Series. The faunal evidence of this study indicates that the Hindsville formation is lower Chesterian in age and that it should be correlated with the Ste. Genevieve formation. This correlation is indirect evidence to support a Lower Chesterian age for the Ste. Genevieve of the type section in Illinois.

The fauna of the Batesville formation of southwestern Missouri indicates that it is equivalent to the Aux Vases, Renault, Bethel, Paint Creek and Cypress formations of the type section in Illinois. The distribution of the forms in the Batesville are controlled by ecological conditions present during its deposition. The Batesville formation lies conformably and transitionally upon the Hindsville formation and their faunas are closely related. It is suggested that most of the difference between the two faunas is probably due to the difference in environmental conditions under which the formations were deposited.

The Fayetteville formation can be divided into three units: Lower Fayetteville, Wedington sandstone and Upper Fayetteville. Only the Lower Fayetteville is present in southwestern Missouri and it is overlain unconformably by Lower Pennsylvanian beds. The fauna of the Lower Fayetteville indicates that it is equivalent to the Golconda, Hardinsburg and Glen Dean formations of the type section in Illinois. The Lower Fayetteville fauna is characterized by the introduction of several new forms and the faunal assemblage is greatly different from those of the Batesville and Hindsville formations. However there is a close relationship between the faunas of the Fayetteville and Hindsville formations which may be due to similar environments existing during the deposition of the two formations.

Microfilm copy of complete manuscript of 407 pages, \$5.09. Enlargements 6" x 8", 10¢ per page.



## MINERALOGY

STRUCTURAL CRYSTALLOGRAPHIC RELATION  
BETWEEN SODIUM SULFATE AND POTASSIUM  
SULFATE AND SOME OTHER SYNTHETIC  
SULFATE MINERALS

(Publication No. 3765)

Mohamed Ezzeldin Hilmy, Ph.D.  
University of Michigan, 1952

A study of the structural crystallographic relations between the following sulfate compounds has been made using x-ray methods as the main tool:  $\text{Na}_2\text{SO}_4$ - $\text{K}_2\text{SO}_4$ ,  $\text{Na}_2\text{SO}_4$ - $\text{Li}_2\text{SO}_4$ ,  $\text{K}_2\text{SO}_4$ - $\text{Li}_2\text{SO}_4$ ,  $\text{K}_2\text{SO}_4$ -( $\text{NH}_4$ ) $_2\text{SO}_4$ ,  $\text{Na}_2\text{SO}_4$ -( $\text{NH}_4$ ) $_2\text{SO}_4$ .

The study of the structural relation between sodium sulfate and potassium sulfate is of particular interest in the field of crystallography because of the fact that each compound occurs in more than one crystallographic modification (polymorph) — 5 in the case of  $\text{Na}_2\text{SO}_4$  and 2 in the case of  $\text{K}_2\text{SO}_4$  — and that there has been some controversy about whether there exists a solid solution relationship or isomorphism or both between certain polymorphs of the two compounds. The existence of such solid solution or isomorphism is of special interest in structural crystallography because of the big difference in ionic radii between sodium (0.98 Å) and potassium (1.33 Å) which is equal to 0.35 Å or 35.7 % of the smaller ion (sodium). Because of this big difference sodium and potassium do not generally form isomorphous compounds. The ionic radii of  $\text{Li}^+$  AND  $\text{NH}_4^+$  are 0.78 Å and 1.43 Å respectively.

Aphthitalite, a sodium potassium sulfate mineral, has been prepared in the laboratory from aqueous solutions as well as from fused melts of various sodium and potassium sulfate proportions. X-ray methods, powder, rotation, and Weissenberg have revealed that at high temperatures close to fusion, sodium sulfate and potassium sulfate are isomorphous and form a complete series of crystalline solid solutions. The same synthetic mineral, prepared from aqueous solutions has been found, by x-ray investigation and checked by chemical analysis, to have a limited range of solid solution varying between the ratios of 1K : 1Na to 5K : 1Na at 70°C. and limited to the almost invariable ratio of 3K : 1Na at room temperature. A gradual increase in the lattice constants as well as the refractive indices has been observed, on increasing the potassium content in the synthesized aphthitalites of the high-temperature complete solid solution series. It is concluded, therefore, that aphthitalite whether of composition  $\text{NaK}_3(\text{SO}_4)_2$  or  $\text{NaKSO}_4$  is to be considered simply as a crystalline solid solution member of the high-temperature form of sodium sulfate and potassium sulfate.

X-ray powder data (theta angles, d, estimated intensity of lines and indices) are given for the double compounds  $\text{LiKSO}_4$  and  $\text{LiNaSO}_4$  and for  $\text{NH}_4\text{KSO}_4$  member of the continuous series of crystalline solid solution  $(\text{NH}_4)_2\text{SO}_4$ - $\text{K}_2\text{SO}_4$ . It is revealed by x-ray powder method that complete immiscibility exists between  $(\text{NH}_4)_2\text{SO}_4$  and  $\text{Na}_2\text{SO}_4$ .

Lattice constants, space group, and Z are given for  $\text{LiNaSO}_4$  for the first time as follows:  $a_0 = 7.45 \pm 0.02$  Å,  $c_0 = 9.76 \pm 0.02$  Å, C31c, Z = 6 molecules of  $\text{LiNaSO}_4$ . A new axial ratio based on x-ray analysis is found to be equal to 1.31 (c : a). Also, a new specific gravity value for  $\text{LiNaSO}_4$  is found, by three different methods, to be equal to 2.515 and, therefore, the old value of 2.369 should be discarded. Two twinning laws have been found common among  $\text{LiNaSO}_4$  crystals. One has (0001) as the twinning plane and the other has (10 $\bar{1}$ 1) as the twinning plane.

Microfilm copy of complete manuscript of 87 pages, \$1.09. Enlargements 6" x 8", 10¢ per page.

MINERALOGY OF THE MOSCOVITE-  
LEPIDOLITE SERIES

(Publication No. 3781)

Alfred Abraham Levinson, Ph.D.  
University of Michigan, 1952

The structures of over 500 specimens of muscovite and lepidolite, approximately 50 of which have been chemically analyzed, have been determined by means of the Weissenberg and powder x-ray methods. On the basis of these data a distinct series between muscovite and lepidolite is demonstrated and the various polymorphs are correlated with their chemical positions within this series. In addition, certain physical characteristics, e.g., grain size and perfection of crystal development of lepidolite, are explained on the same chemical basis.

Uniaxial lepidolite, heretofore regarded as extremely rare, has been observed in the specimens from at least 6 localities and is explained by means of twinning. A new polymorph of lepidolite and a new variation of the normal muscovite structure have been found and are described.

The indices of refraction and 2V have been determined for approximately 200 specimens of pegmatitic muscovite. The information obtained has enabled correlation between color and optical properties of the various paragenetic types of muscovite. Correlation of optical constants among the lepidolite polymorphs has not been successful.

Microfilm copy of complete manuscript of 129 pages, \$1.61. Enlargements 6" x 8", 10¢ per page.

## HUMANITIES

### ART AND ARCHEOLOGY

#### THE ARCHEOLOGICAL SEQUENCE ON MARAJÓ ISLAND, BRAZIL, WITH SPECIAL REFERENCE TO THE MARAJOARA CULTURE

(Publication No. 3905)

Betty Jane Meggers, Ph.D.  
Columbia University, 1952

Archeological fieldwork was undertaken on the Island of Marajó in the mouth of the Amazon during 1949-1950 in an attempt to clarify the position of the mound-building culture previously known only from selected and poorly-documented ceramic collections. Fifteen sites (one composed of 20 artificial mounds) were mapped and excavated on the north-central coast and in the center of the Island, representing 5 distinct cultural groups. All except the Marajoara (mound-builders) are comparable to living Tropical Forest cultures.

The earliest is the Ananatuba Phase, found in a trianguloid area between the north coast, Lago Ararí and the Igarapé Camutins. Ceramically, it is distinguished by two plain wares, light-gray Ananatuba Plain and Sororoco Plain, with a rosy to orange surface, and two decorated wares, Sipó Incised and Carmo Brushed. Villages were composed of a communal dwelling in the forest at the edge of the campo. This culture dies out with its conquest by the Mangueiras Phase.

Mangueiras Phase sites occur over part of the Ananatuba Phase territory, in the vicinity of Chaves and on southern Caviana. Two plain wares form the basis for seriation, the reduced-fired Mangueiras Plain giving way to the oxidized-fired Anjos Plain. Decoration is principally by brushing and scraping, with the addition after Ananatuba Phase contact of Pseudo-Sipó Incised, copying Sipó Incised designs. Villages composed of single-family houses were located in the forest close to a navigable stream.

Stratigraphic linkage between the Mangueiras Phase and its successor was not found, but Sipó Incised motifs on Formiga Phase pottery indicate contact with the latter part of the Ananatuba or Mangueiras Phase. Formiga Phase villages are located in the campo on north-central Marajó. Seriation is based on stratigraphic changes in the frequency of three plain wares: Formiga Plain with a polished surface, Embaúba Plain with a grayish-tan surface, and Coroca Plain with a cream to reddish surface. Decoration is comparatively nondescript, but two important influences are evident: the sudden introduction of corrugation from the west, and the appearance of Marajoara types, which marks the end of the Phase.

The Marajoara Phase, with artificial mounds, elaborate and diversified ceramics, pottery stools and tangas, and secondary urn burial provides a

strong contrast with the earlier cultures. Mounds have been recorded over most of the eastern half of the island. Habitation mounds produce almost exclusively plain ware, while the 14 decorated types are predominantly ceremonial and associated with cemeteries. Stratigraphic analysis and seriation of the ceramics shows that Marajoara culture possessed social stratification and occupational division of labor, and that its history on Marajó is one of decline. Consideration of the subsistence resources theoretically necessary for the development of such a level of culture focuses attention on the northwestern portion of South America as potentially the most suitable. Comparative archeological and ethnographical analysis shows the strongest frequency of diagnostic Marajoara traits in that region. The tempering of the strictly highland environment in the Ecuador-Colombia center of this area and the presence of rivers leading into the Amazon are further conditions favoring this center of dispersal for Marajoara culture.

The remnants of the declining Marajoara Phase were absorbed or expelled by the expansion from the mainland of the Aruã, who possessed a typical Tropical Forest type culture with small scattered villages and simple utilitarian pottery (Piratuba Plain). The Aruã were the principal tribe on eastern Marajó at the advent of the Europeans in 1500 A.D.

Microfilm copy of complete manuscript of 397 pages, \$4.96. Enlargements 6" x 8", 10¢ per page.

### DRAMA

#### THOMAS HOLCROFT AND ELIZABETH INCHBALD: STUDIES IN THE EIGHTEENTH- CENTURY DRAMA OF IDEAS

(Publication No. 3911)

Bruce Robertson Park, Ph.D.  
Columbia University, 1952

This study attempts to exhibit some of the relationships between two later eighteenth-century dramatists of ideas, Elizabeth Inchbald and Thomas Holcroft, and their intellectual milieu.

Viewed panoramically the eighteenth century shows two pervasive modes of apprehension, rationalism and sentimentalism, which issue concretely under the forms of many aspects of life. Rationalism embraces two quite different outlooks: first, reasonableness, which includes both the common sense of the common man and the more truly empirical view of enlightened men; second, technical rationalism, a faith that final truth can be obtained by pure reason and will be simple.



As common sense reasonableness was represented in the spirit of the revolution of 1688, in the merchant middle class and its attempts at political reform in the seventies and eighties; as empiricism it characterized science and that philosophy which dealt primarily with sensible phenomena. Both tempers existed throughout the age, but it is the blending of a *priori* and a *posteriori* which individualizes eighteenth-century thought.

The second mode, sentimentalism, here defined as the depiction or enjoyment of emotion not proportionate to its causes, is quite opposite to rationalism in its implicit anti-intellectualism. Sentimentalism — to be associated with middle class philanthropy and humanitarianism — invaded and, after the mid-century, virtually captured literature.

These modes permeated literature in general, the drama in particular. This drama was largely sentimental in content, rationalistic in theory, rigidly formal in technique, derivative in plot, hampered by emphasis on actor and physical theater. Since it was viewed as properly a teacher of moral ideas, it was in a sense a drama of ideas by definition.

In Holcroft it became a teacher of a system of social and political ideas, that of Godwin in *Political Justice*. Holcroft's plays reflect the incompatibility of the sentimental and rationalistic modes, for they project Paine's emotion-suffused "natural rights" view almost as often as Godwin's intellectualized concept of "duty." They fail as dramas of ideas because Holcroft's instinctive artistic vision was not in harmony with his *a priori* intellectual view; for example, characters often illustrated over-simplified Godwinian psychology rather than Holcroft's experience of human nature. Holcroft represents eighteenth-century faith in pure reason and exemplifies the effects of that faith in a drama which attempts to objectify a system based upon pure reason.

Mrs. Inchbald represents the dilemma of the Roman Catholic in an age of reason and sentimentality. Her powers were essentially comic; at her best she objectified in comic situations an analysis of society and, to a lesser extent, political institutions in their function as teachers; the analysis was her adaptation of Rousseau's. Holcroft preached, she ridiculed. A flexible, skeptical mind, a scholar's temperament which made her strive to understand facts, not to attain rational consistency, emerges in her plays and puts her primarily in the rational-empirical tradition. Yet, as in Holcroft, one finds sentimental humanitarianism issuing occasionally in the form of preachment.

Both dramatists were at least symbols, although less than microcosms, of certain ways of looking at the world which gave the eighteenth century its individuality.

Microfilm copy of complete manuscript of 333 pages, \$4.16. Enlargements 6" x 8", 10¢ per page.

## JOURNALISM

### A STUDY OF THE MISSOURI FARMERS ASSOCIATION, WITH SPECIAL REFERENCE TO THE PUBLIC RELATIONS ASPECTS

(Publication No. 3833)

Raymond William Derr, Ph.D.  
University of Missouri, 1952

From the first Farm Club, organized in the New-comer Schoolhouse in Chariton County by Aaron Bachtel and six of his neighbors on March 10, 1914, the Missouri Farmers Association has grown to a statewide association of approximately 140,000 members.

Factors which brought about the success of this farm movement after the failure of the Farmers' Alliance, and to some extent, of the Grange and the Farmers' Union, largely have been the work of the late William Hirth. Hirth founded *The Missouri Farmer and Breeder*, later *The Missouri Farmer*, and began to preach cooperation. This led to Bachtel's organization of the first club, and, in 1917, to the formation of the state association. Hirth brought this about almost singlehandedly. He used his magazine and his own powers of oratory as the tools for success.

Hirth's frankness and willingness to take the membership into his confidence in print, through *The Missouri Farmer* and pamphlets and other literature, helped his cause tremendously. He thereby created a loyal, informed membership. By insisting that the Association limit its business efforts to products grown or needed by farmers, he allayed fears of small-town businessmen. By avoiding political activities of the earlier farm groups, the Association gained the friendship of other publics.

Hirth's successors, after 1940, recognized the need for a continuous program of information and explanation of the Association's objectives, not only to its rapidly-growing membership, but also to the non-member farmer, and the state's non-farming population.

These present-day leaders recognize that the farmer, as a group, is now a minority, and that the favor of other groups is imperative. Accordingly, the Association's public relations activities are directed toward these publics, and, at the same time, more efforts are being made toward keeping the membership informed.

Today, the Association owns and operates a modern publishing and printing plant and a powerful radio station, has an aggressive public information service, buys an average of four hours' radio time daily over more than a dozen stations for its affiliates or activities, and utilizes a motion picture program to widen its scope of informational service.

The Association has a well organized plan for orienting new employees, managers, and affiliate board members. Its record of public service is among the best of such organizations in Missouri.

One of the Association's greatest contributions to public welfare has been its untiring work in the

interest of what it believes to be proper legislation for the farmer, and for the state as a whole. The Association can be credited with securing passage of the state's present school equalization laws and legislation requiring careful expenditure of public funds by state and local governments; and bringing about the passage of a soils conservation law, the King Road Act, and numerous acts designed to insure fair weights, fair grading and testing of farm products, feed, seed, and fertilizer. Through William Hirth, the Association focused attention upon the undesirable boss rule which dominated state and metropolitan politics.

In recent years, the Association has fought for an enlarged road program, and has supported additional rural electrification and rural telephone programs and the move for an enlarged state medical school.

This study has provided ample evidence to justify the assumption that the public relations policy of the Missouri Farmers Association is of a high order, and that it has consistently set a high record for integrity, honesty, and service, not only to its membership, but to Missouri farmers generally, and to the state.

Microfilm copy of complete manuscript of 550 pages, \$6.88. Enlargements 6" x 8", 10¢ per page.

#### THE ORGANIZATION AND ADMINISTRATION OF TELEVISION PROGRAMMING FOR SCHOOL SYSTEMS AND INSTITUTIONS OF HIGHER LEARNING

(Publication No. 3843)

Edward Charles Lambert, Ph.D.  
University of Missouri, 1952

#### The Problem:

This study has two major purposes. First, to survey the organizational and administrative practices which determine the educational television activities of school systems and institutions of higher learning. Second, by virtue of this study, to expedite the use of television for educational purposes by supplying public spirited citizens, educators, and commercial television executives with needed information that previously has not been available.

#### Method of research:

The normative-survey method of research was in this study. Two Information Blank mailings were made — one to television executives in the nation's 107 TV stations and one to educational institutions listed by these executives or by the Federal Office of Education as actively engaged in educational television programming. Replies were received from eighty-one television stations representing a return of 75.6 per cent of the stations queried. Responses were received from 152 of the 156 educational institutions queried for a 97.4 per cent return.

#### Summary:

(1) Ninety-five and five-tenths per cent of the 112

respondents who actively are engaged in educational TV activities use the facilities of privately owned and operated commercial stations.

(2) There are no strictly non-commercial, educational stations in operation at the present time.

(3) There are no educationally owned, commercially licensed stations in operation.

(4) Approximately nine out of ten of the educational institutions that rely on commercial facilities produce the majority of their programs in the studios of cooperating commercial stations. Ninety-seven and nine-tenths per cent of these stations furnish their facilities free as a public service.

(5) Cooperating TV stations furnish most of the equipment used by educational institutions in their video programming.

(6) Because of the newness of television as an educational tool, a number of control patterns are in evidence in the administration of television operations.

(7) Despite the variety of control patterns, nearly sixty per cent of the TV operations are administered by one of the following three divisions: Administration, Radio and Television, or Speech and Drama.

(8) Only a small minority of the educational institutions pay their faculty for full-time work in educational TV. Almost a third of the institutions pay faculty members for part-time TV work.

(9) Only 3.8 per cent of the institutions employ full-time professional television personnel.

(10) Educational TV is making the same mistake that was made by early radio — a mistake that led to the demise of a majority of the early educational radio ventures. Too many faculty members are being given added TV loads with no extra remuneration.

(11) An encouraging sign is apparent in the amount of cooperation being given educators by commercial stations.

(12) Only one college and two universities grant degree credit for courses taken by television. These three institutions and two additional universities offer certificate courses.

(13) More than one-third of the educational institutions that are presenting video programs are doing so in the late morning hours.

(14) A majority of the educational institutions rely on live telecasts for their educational programming.

(15) Approximately three-fourths of the respondents whose educational institutions use films reported that they produce their own.

(16) Audience reactions to educational programs have been extremely favorable.

(17) The median cost estimate for establishment of an educational TV station is \$235,000. Median weekly operating estimate is \$4,000.

Microfilm copy of complete manuscript of 289 pages, \$3.61. Enlargements 6" x 8", 10¢ per page.



BOVARD OF THE POST-DISPATCH

(Publication No. 3848)

James Walter Markham, Ph.D.  
University of Missouri, 1952

Oliver Kirby Bovard, who served the St. Louis Post-Dispatch forty years, was the last of Joseph Pulitzer's great editors. Before his retirement from the managing editorship in 1938, he was widely recognized for his remarkable journalistic achievements and for the high quality of his professional standards. Because of his conviction that newspaper men must remain free from personal associations that might bias their news judgment, Bovard was little known to the public by his own choice; but members of the profession regarded him with great admiration and respect.

Bovard's rise to power was meteoric. Going to the Post-Dispatch in 1898 from an obscure reporter's position on the St. Louis Star, he advanced to the city editorship in only two years. From 1900 to 1908 he made the Pulitzer paper first in local news in the city. After a brief period of training on Pulitzer's New York World, Bovard returned to St. Louis to become the Post-Dispatch's Managing Editor in 1910. He established the paper's Washington Bureau and realized an ambitious policy of news coverage and function that lifted the paper out of its regionalism and made it a great journal of national influence. In the late twenties the Post-Dispatch came to be regarded by journalism students as one of the three or four foremost dailies in the country. Senator George W. Norris called it "the Manchester Guardian of America," because of its enlightened views, its independence, and its courage.

Bovard brought to newspaper work the zest and devotion of a dedicated man. He saw the newspaper reporter as a truth-seeker and the news as a shield against corruption and as a spear of progress. Recognizing no lesser authority than the public welfare, he believed and practiced the Pulitzer principle that news and editorial success for a newspaper assures business success. It was his aim to permit nothing to interfere with his single-minded determination to get and print all the news. Obviously he made great demands on his staff; and he could be cold, rude, and even ruthless when condemning slovenly performance or interference. However, his men were loyal; and he succeeded through the years in developing a distinguished staff. Bovard's news sense and professional skill were exceptional. Probably he was best as a "general" of a news campaign — where his qualities of fearlessness, persistence, calm judgment, and decision were demonstrated. Among his many campaigns were the exposé of the Teapot Dome oil scandals, the unseating of a Federal Judge, George W. English for official malfeasance, the disclosures of the Kelley kidnaping and Muench baby hoax, the crusade against padded vote registration lists, and the revelation of the Union Electric bribery fund. But Bovard was not satisfied with crusades against corruption in government and business. He sought to make his newspaper serve as "a people's univer-

sity," interpreting complex social and economic problems, such as the great depression. Besides keeping his readers well informed and instructed, he succeeded phenomenally in improving conditions in his community and state, and helped make the federal government cleaner and more progressive.

Bovard was the greatest single personal force in the guidance of the Post-Dispatch in the period dating from the death of the founder in 1911 until he left the paper in 1938. He deserves to be ranked with Carr V. Van Anda, a contemporary Managing Editor of the New York Times, as one of the great Managing Editors of his time.

Microfilm copy of complete manuscript of 443 pages, \$5.54. Enlargements 6" x 8", 10¢ per page.

## LANGUAGE

## A HISTORY OF THE PARTITIVE INDEFINITE CONSTRUCTION IN THE SPANISH LANGUAGE

(Publication No. 3715)

Lester Beberfall, Ph.D.  
University of Michigan, 1952

The purpose of this study is to present a history of the partitive indefinite construction in the Spanish language. The construction has the meaning "some" or "some of the," indicating an indefinite part of a stated whole or totality. Structurally, it is made up of the preposition *de* plus the definite article, or some other determinant, and is followed by a substantive or a pronoun. The following are samples of the construction in context: *Mi amigo me dió del dinero*; *Coma Ud. de este pan*; *Tráeme de mi vino*; *Mi padre prefería perder de lo suyo que tomar de lo ajeno*.

The construction is obsolete in modern Spanish, but was used continuously from the beginnings to the early part of the Seventeenth Century, when it was imperceptibly displaced by other forms.

In Old Spanish the construction indicated an indefinite part of a definite whole. In order to show that this was a continuation of the meaning in Vulgar Latin, Chapter I is devoted to the Latin background. The Vulgate Bible was used as the main source of examples.

Chapter II presents the partitive idea in the Romance Languages. Having the same source as Spanish, the old forms of these languages use the partitive indefinite construction in similar fashion. The Chapter also shows how the meaning was modified in French and Italian.

Chapter III is the main body of the study. Beginning with the Cid, at least one text for each century is investigated. Every example of the construction is listed. All, but the most obvious, are analyzed. To strengthen the analysis, the converse of the partitive indefinite construction is presented in the form of several examples from each text in which the

construction is not used. Abstractions are included as well as material objects. Used in the generic sense, they can be said to express an indefinite part of an indefinite whole. Thus, in the sentence, *Necesito dinero para comprar libros*, the substantives serve only to identify what I need and what I will buy and are not expressed as parts of an indicated or implied whole.

Chapter IV presents in chronological order texts of the Seventeenth Century, showing that the construction begins to share the stage with forms like *algunos* and *unos*, and, by the end of the century does not appear at all.

Two general conclusions can be drawn from the study. 1. Outside of the *Lozana Andaluza*, which reflects Sixteenth Century Italian influence in some of its examples, the partitive indefinite construction indicates an indefinite part of a definite whole. While French and Italian were modifying the meaning of the construction, Spanish was dropping it entirely, leaving the modern investigator a remarkably homogeneous pattern.

2. Since elements of syntax cannot be decreed in or out of a language, it is safe to say that the partitive indefinite construction was used by Cervantes in equal proportion to other forms, but was already rare in Quevedo.

Microfilm copy of complete manuscript of 155 pages, \$1.94. Enlargements 6" x 8", 10¢ per page.

## LINGUISTICS

### THE AMERICAN ENGLISH PRONUNCIATION OF RUSSIAN IMMIGRANTS

(Publication No. 3872)

Marshall Daniel Berger, Ph.D.  
Columbia University, 1951

The main aim of this study is to compare the sound patterns of Great Russian and of American English as manifested in the everyday speech of Russian immigrants residing mostly in New York City, and thereby to describe and explain the nature of the Russian 'accent' in American English.

The main assumption on which the investigation is based is that the phonemic pattern of Russian speakers is the starting point for their approach to English as a foreign language, regardless of their greater or lesser ability to speak it.

The Russian speaker uses those Russian phonemes which he judges to be closest to those of English in any given word or phrase. Vowel between hard (phonetically: labiovelarized) consonants are rendered as they would be in Russian, even though English recognizes no such relationships. In other situations, the appropriate vocalic positional variants are used if the consonants surrounding them are palatalized enough from the Russian standpoint

to be considered 'soft,' apart from the fact that English vowels vary little from position to position. Furthermore, the slight palatalizations of the English consonants is replaced by the heavy palatalization of Russian; the non-palatalized English consonants are automatically given the strong labio-velarization of their Russian counterparts.

The failure to articulate the sounds of foreign language and to distribute them properly is well-known even to laymen as the source of foreign 'accent,' but the significance of the phoneme with its differentiative function in speech has only comparatively recently begun to penetrate in the practical field of language teaching. In this work phonemic principles, wherever applicable, will be emphasized.

Up to this point we have assumed that Russians in this country learn English only by listening to Americans speak and then doing their best to imitate them. Obviously, this is not the whole story. For there is not only the oral source of pronunciation, but also the pseudo-oral, i.e. pronunciation based on the letter-phoneme conventions of the speaker's native language. This problem is also taken up within the framework of the investigation, as well as the important problem of hypercorrection and its various manifestations.

The information used in this study was gathered largely from ten regular informants plus many casual informants; people met and spoken to in the Russian community, students at Columbia University and the City College of New York, and speakers on radio programs.

The regular informants are all native speakers of standard Great Russian representing such cities and areas as: Moscow, Leningrad, Rostov, Minsk (Byelorussia), Novogrudok (Western Byelorussia), Stavropol' (Caucasus).

Almost all of the informants, whether of the émigré, Soviet, or other groups, are very literate, conscious members of the intelligentsia. In most cases not only they but their parents received at least a European secondary school education.

Microfilm copy of complete manuscript of 202 pages, \$2.53. Enlargements 6" x 8", 10¢ per page.

### A PHONEMIC DESCRIPTION OF THE ARAN DIALECT OF MODERN IRISH, WITH A DETAILED CONSIDERATION OF PROBLEMS OF PALATALIZATION

(Publication No. 3892)

John Paul Hughes, Ph.D.  
Columbia University, 1952

The dialect described is that spoken in the Aran Islands, at the mouth of Galway Bay — hence a typical Connaught (northwestern) Irish dialect. The material consisted of (1) recordings made by Michael Mullen, a native of the islands, for the *Linguaphone* Irish course in 1928; (2) observations and notes taken in the islands by the author in 1947; (3) recordings made in 1951 of the speech of Martin Thornton, a native



speaker of Irish from Spiddle on the mainland about ten miles from Aran.

The Aran dialect was found to have 48 distinct phonemes (although there are numerous neutralizations of individual oppositions under particular conditions)—36 consonants and 12 vowels. The consonant system is characterized by a correlation of palatalization, and may be presented in the following pattern:

p <sup>ˆ</sup>	b <sup>ˆ</sup>	m <sup>ˆ</sup>	f <sup>ˆ</sup>	t <sup>ˆ</sup>	d <sup>ˆ</sup>	n <sup>ˆ</sup>	l <sup>ˆ</sup>	r <sup>ˆ</sup>	s <sup>ˆ</sup>	k <sup>ˆ</sup>	g <sup>ˆ</sup>	y <sup>ˆ</sup>	x <sup>ˆ</sup>	ɣ <sup>ˆ</sup>
p'	b'	m'	f'	t'	d'	n'	l'	r'	s'	k'	g'	y'	x'	ɣ'
	w	v				n	l	r	s					h

Here the phonemes followed by a circumflex (<sup>ˆ</sup>) are characterized by labialization or velarization, or both; those marked by an accent (') are palatal and in all but two cases palatalized.

The vowel system — characterized by a correlation of tense vs. lax which includes all the vowels except one — forms this pattern:

i	e	u	o	ɔ	ɑ
I	ɛ	ʊ	ʌ		a

Not all palatal sounds are palatalized, and it is pointed out that palatalization can be accomplished by two distinct articulations: (1) by producing a front vowel concomitantly with the articulations relevant for a phoneme (the term *copalatal* is used for this articulation), (2) by making the contact or approximation of tongue to palate characteristic of any given phoneme broader and more extensive, for example by producing a [t] with the blade of the tongue instead of the tip (the term *latipalatal* is used for this articulation).

On the basis of Irish, it is suggested that a correlation of palatalization can be postulated by the analyst of a language only (1) when all palatalized phonemes are copalatal, or (2) when both copalatal and latipalatal are present; that when only latipalatal are present, a different classification has to be adopted, as shown in representative phonemic analyses of the consonant systems of Russian, Czech, Spanish, Italian and French. It is further suggested that there may be a tendency for copalatal phonemes to shift to latipalatal articulation.

It was found that "degrees" of palatalization are possible only with copalatal articulation, and even there are probably not phonemically relevant. It is noted that the correlation of palatalization appears to be weakening in modern Irish, since the palatalized/velarized opposition is neutralized with considerable frequency; and even where it is not, the marked phoneme is usually accompanied by a non-relevant "support" feature, which could become phonemic and lead to elimination of the palatalized phoneme. This leads to a discussion of glides before and after palatalized sounds, and their phonemic behavior, in connection with which the replacement of palatalized sounds by affricates (e.g. in the transition from Vulgar Latin to the Romance languages) is considered.

Finally, the probable origin of palatalization in Irish is outlined, and conjectures are made as to

what phonemic changes may be expected to take place in the Aran dialect in the future. The Appendix reviews those of the past 50 years on the basis of an 1895 description of the dialect. Texts, translations and bibliography conclude the dissertation.

Microfilm copy of complete manuscript of 158 pages, \$1.98. Enlargements 6" x 8", 10¢ per page.

#### RESEARCH PROBLEMS IN BILINGUALISM, WITH SPECIAL REFERENCE TO SWITZERLAND

(Publication No. 3926)

Uriel Weinreich, Ph.D.  
Columbia University, 1951

Part I, entitled "Approaches to Bilingualism," constitutes a critical review of the pertinent research literature in English, German, French, Danish, Swedish, Romansh, Russian, Polish, Yiddish, and Hebrew. First those studies are examined which treat bilingualism as a problem of the individual, e.g. those dealing with psychological and neurological theories of bilingualism, the terms in which bilingualism can be measured and characterized, and the effects of bilingualism on intelligence, character formation, etc. A number of special educational implications are also included. A second chapter surveys research on the sociology and the spatial aspects of bilingual groups; the question of "upper" and "lower" language is discussed and a new, differentiated definition of "prestige" is offered. The problems involved in the relationship of the unilingual bulk of a language community to its bilingual fringes are outlined. The third chapter deals with the linguistic side of bilingualism, i.e. its effects on language usage. Differences in the amount of borrowing which occurs in various bilingual situations are examined in the light of structural and cultural resistance to borrowing. Finally, the effects of bilingualism on substratum formation and related processes are briefly surveyed. The overall conclusion of Part I is that the several approaches to bilingualism are complementary and that all are essential in comprehending a phenomenon of so many dimensions.

For the purpose of examining concrete bilingual situations from a number of points of view, quadrilingual Switzerland was chosen. Part II of the dissertation embodies the results of a year's research in that country on a fellowship from the American Council of Learned Societies. The study is developed according to the thesis that a full explanation of the direction of language influence, the extent of influence, and the domains of the linguistic structure most affected must include an analysis of the specific cultural and social setting in which the languages are in contact. First a number of *intralingual* contact situations are examined, particularly the question how the Schwyzerdütsch language has been maintained against the pressure of Standard German. The relations between patois and Standard French; Common Lombardic, Ticino dialects, and Standard Italian; and

between the several varieties of Standard Romansh are drawn upon for comparison. In the second chapter two interlingual contact cases are examined: a static French-German bilingual situation in the canton of Fribourg, in which the population has been bilingual for centuries, is contrasted with a dynamic bilingual situation in central Grisons, where, in a language shift, Romansh is being displaced by German. Each area is shown in the context of the larger language-border region to which it belongs. Language statistics are analyzed to demonstrate the insignificant fluctuations in the stable area and the unmistakable downward trend of Romansh in the region of the shift. A hitherto unpublished special language census for the Romansh area is utilized to illuminate the social processes of a language shift in detail. The prestige configurations in each pair of languages — balanced in the stable French-German area, unbalanced in the shifting Romansh-German one — are examined. It is shown how the topography of each area helps shape the fate of the languages. Lastly, those factors of each situation are reviewed which are relevant to interlingual influence, such as tolerance of speech errors by each culture and possibilities of habitualization of speech errors (i.e. language change). The difficulties of speakers of each language with the other tongue are outlined in the form of a *grammaire des fautes*, and examples are cited of errors actually committed by bilingual child informants in the course of recorded interviews with the author.

Details of the research material are presented in a number of appendices. A bibliography of 572 items concludes the dissertation.

Microfilm copy of complete manuscript of 568 pages, \$7.10. Enlargements 6" x 8", 10¢ per page

## LITERATURE

### WALTER BAGEHOT: A STUDY IN RELIGIOUS COMPROMISE

(Publication No. 3935)

Robert James Ames, Ph.D.  
University of Minnesota, 1952

Walter Bagehot (1826-1877), banker, economist, political scientist, layman social psychologist, literary critic, and moralist, has been correctly described as a "typical" representative of the Victorian Age of compromise. Since an understanding of a man's religious presuppositions is prerequisite to an understanding of his personal character, and since the religious tone of an age is most important to an understanding of its meaning, the nature of Walter Bagehot's religious compromise will be valuable in any approach to an understanding of the Victorian compromise in religion.

Bagehot's compromise was thrust upon him from

the beginning. His mother was an Evangelical Anglican, his father a serious-minded Unitarian. His parents refrained from trying to force any sectarian decision upon him so that he grew up knowing how to respect and value a diversity of religious views. He became an Anglican, formally, but always managed to retain some of the theological liberalism implicit in his father's faith.

After having recovered from a youthful flirtation with the Church of Rome, Bagehot began to make his own religion out of the materials which influenced him during his stay at the University of London. The Unitarian influence was continued through his intimate friend, Richard Holt Hutton. Arthur Clough impressed on him a dread of "the ruinous force of the will"; Henry Crabb Robinson made him aware of German metaphysics, his University education exposed him to the influence of the Radical Philosophers, while frequent trips to Oxford gave him a life-long interest in the high Anglicanism of Newman and the Tractarians.

Throughout his early "Literary Studies" we see Bagehot steering a course between the extremes of Puritanism and Paganism, Hebraism and Hellenism, to arrive at a philosophy of experience and a love of this world as a necessary condition for a knowledge and love of the next world. In the essays on "Bishop Butler" and "The Ignorance of Man" he insists on the necessity for belief in a veracious Deity and establishes conscience (augmented by Reason) as the organ of valuation for all religious revelation.

In politics and economics Bagehot consistently seeks the "middle principles." He was, as he said, "between sizes in politics" — neither Whig or Tory but something of each. His natural good spirits approve "Progress" but his intuitions of life's "darker aspects" and particularly of the doctrine of Original Sin act as a deterrent to liberal naivete and the classic liberal belief in the perfectibility of man.

Bagehot joined the Metaphysical Society shortly after its founding in 1869 and read two papers for it: "The Emotion of Conviction" and "The Metaphysical Basis of Toleration." Both papers show the influence of his research into Darwinism, modern psychology, and Biblical higher criticism, although at no time can Bagehot be accused of having abandoned the basic tenets of Anglican orthodoxy.

Bagehot's compromise was never "final" in the sense that he succeeded in working out a system of beliefs to reconcile the worlds of modern science and traditional Christianity. As a Christian, he was an Anglican with an Evangelical conscience and a Unitarian reliance on reason. As a man, he was something of a humanist, midway between the overbearing pride of the Renaissance and the ironic detachment of Thomas Mann.

Bagehot found a Middle Way, a *modus vivendi* which allowed him to accept the necessary condition of man and to survive somewhere between the worlds of God's omniscience and Lombard Street. He compromised, but not from fear or ignorance; his middle way was born of courage and intellectual honesty. He knew both worlds and honored both, but he also knew that "such a creature as man in such a world as the present one" must strive to "make the best of both



worlds.... We know that we see as in a glass darkly; but we still look on the glass.... This is, as it seems, the best religion for finite beings...."

Microfilm copy of complete manuscript of 410 pages, \$5.13. Enlargements 6" x 8", 10¢ per page.

**THE KŌNZYAKU MONOGATARISYŪ:  
AN HISTORICAL AND CRITICAL  
INTRODUCTION, WITH ANNOTATED  
TRANSLATIONS OF SEVENTY-EIGHT TALES**

(Publication No. 3724)

Robert Hopkins Brower, Ph.D.  
University of Michigan, 1952

This study concerns the *Kōnzyaku monogatarisyū*, a huge collection of more than one thousand short religious and secular tales and anecdotes from India, China and Japan. It is the largest tale collection produced in old Japan, and is one of the first of many similar works written between the late eleventh and fifteenth centuries. The purpose of the study is to introduce to the western scholar this collection, which, despite its great size and the great claims that have been made for it by native scholars, is relatively little known in the western world except to a handful of Japanologists. The study is divided into two major sections: (a) an Introduction, in which an attempt is made to place the *Kōnzyaku monogatarisyū* in the stream of Japanese literature; and (b) annotated translations of seventy-eight tales selected from the section of the work devoted to Japanese tales.

The Introduction is divided as follows: (1) a description of some of the major Indian and Chinese Buddhist tale-collections which directly influenced similar early collections in Japan, together with a history of the most important early Japanese collections of Buddhist tales produced from the ninth to the end of the eleventh century; (2) a history of non-Buddhist narrative writing in Japan from the beginnings to the early eleventh century; (3) a description of the social and literary scene in Japan in the eleventh and twelfth centuries; (4) a discussion of the contents of the *Kōnzyaku monogatarisyū*, the manner in which the stories are arranged, and the basis upon which the selection of seventy-eight tales for translation was made; (5) a discussion of the relationship between the *Kōnzyaku monogatarisyū* and the written sources from which many of the stories were derived, together with an estimate of the purpose for which the collection was compiled; (6) a discussion of the problems of the authorship and date of the work; and (7) an estimate of the position of the *Kōnzyaku monogatarisyū* in the stream of Japanese literature.

The seventy-eight tales translated and annotated are selected in such a way as to provide at least one example from each of the major topical groups under which the Japanese stories are arranged in the original work. The result is to give a representative

picture of the various kinds of tales included in this portion of the *Kōnzyaku monogatarisyū*, and to show at the same time the nature of many of the tales included in a number of similar works.

The Introduction leads to five general conclusions. (1) The *Kōnzyaku monogatarisyū* is in large part a derivative work with very little intrinsic literary value. (2) It was written for a specific practical purpose: to be read aloud for the enlightenment, instruction, and amusement of an uneducated group of people. (3) The principal theories advanced by Japanese critics as to the authorship and date of the work are open to serious objections: there are strong indications that it is not entirely of the first three decades of the twelfth century, as is generally claimed, nor the work of an aristocratic compiler or compilers. (4) Unlike most prior tale collections compiled for a similar purpose, the *Kōnzyaku monogatarisyū* includes many historical, humorous, and other secular tales and anecdotes in addition to conventional Buddhist apoloques. (5) Its position in the stream of Japanese literature is that of a transitional work, which represents in content and style a new stage in the development of Japanese popular literature in the early feudal age.

Microfilm copy of complete manuscript of 1067 pages, \$13.34. Enlargements 6" x 8", 10¢ per page.

**THE CRITICAL THEORY OF DAVID HUME**

(Publication No. 3880)

Ralph Cohen, Ph.D.  
Columbia University, 1952

David Hume expressed an interest in critical theory even before he wrote the *Treatise of Human Nature*. In that *Treatise*, published in 1739-40, he planned to deal with the "sciences" of logic, morals, criticism, and politics. Although he dealt with logic and morals at length, he treated criticism incidentally. He dealt more extensively with it in his essays and his volume *Four Dissertations* (1757). But Hume's concern with critical theory pervades all his works, and it is necessary to examine these in order to present his theory from its tentative beginnings to its mature presentation.

Hume's theory related primarily to literature, and it was significantly different from the dominant neo-classical theory of his own time. The unity of a poem, he declared, was based on association of ideas, such as resemblance, causality, contiguity, and contrariety. He proposed a theory of contemplation as the basis of artistic experience, and he assumed that this contemplation involved seeing the object as an entity, grasping the relation of the parts to the whole, and recreating the object. Different works were governed by different ends, and works whose end was utility were perceived differently from works whose end was the communication of emotion.

Hume began his critical theory with the Cartesian distinction between fiction and truth, but this distinction

which was based on the dangers of the imagination and its lack of truth, was transformed into a distinction between two kinds of reality or truth. Hume wavered between poetry as fiction and poetry as a true perception of human nature. But if he never completely resolved this dilemma, he converted a metaphysical into an artistic problem.

Hume's attack on imaginative arts was almost always based on grounds of phantasy and failure to deal with human experience. His interpretation of "experience" was limited, for fairies and dragons are as much a part of human imagination — and human experience — as the wars of the Greeks and Trojans. But what is significant in Hume's objection is that he sought to base all art on human experience and to make art germane to human life. In his account of the rise and progress of the arts he indicated that the arts as an institution sprang from the security of free governments, but he also realized that each art tended to follow its own development.

In "Of Tragedy" and "Of the Standard of Taste" Hume attempted to formulate a critical method. Art was characterized by the transformation of actual into imaginative feeling in a unified work. The judgments of such a work were based on sensitive and intelligent observation of the work in its own terms. In his attempt to extend the experimental method to critical judgments, Hume insisted on fact and observation as the basis of judgments. Although Hume used the psychological jargon of general human nature and "internal fabric," his method was not founded on a priori principles but on observed procedures. All criticism had to be characterized by particulars, not generalizations. The criteria which Hume set up were intensity of response, range of experience, and imaginative coherence. But more important than the criteria was the method by which they were achieved.

There were areas in which Hume's ideas were inadequate. He failed to provide for an adequate separation of the arts, and he tended to believe that there was one true standard rather than different standards for different works. Moreover, in his practical judgments he was often guided by his personal prejudices rather than by his theory. But his contributions to critical theory were significant. His critical method was developed by Burke, William Richardson, and Kant. His distinction between art and life was followed by Lord Kames, John Aiken and Erasmus Darwin. He helped make it possible for critics of the nineteenth century to formulate aesthetic problems as distinct from moral and metaphysical problems.

Microfilm copy of complete manuscript of 402 pages, \$5.03. Enlargements 6" x 8", 10¢ per page.

# JOHN MASEFIELD: INTERPRETER OF ENGLAND AND ENGLISHMEN

(Publication No. 3929)

Fraser Bragg Drew, Ph.D.  
University of Buffalo, 1952

John Masefield's chief dedication is to the interpretation of "the English spirit," the land and heritage from which it springs, and the men and deeds which it inspires. This dissertation proposes to examine these interpretations, to see what phases of English life and evidence of the English spirit Masefield's work presents, and to show the relationship between this dedication and Masefield's Laureateship. The bibliographical appendices are offered as a contribution to Masefield bibliography.

John Masefield began writing as the self-appointed poet of the common man. The first poem of his first book, *Salt-Water Ballads* (1902), is "A Consecration" of his work to the cause of the common soldier and the common sailor. Although the sailors and the yarns of Masefield's early books are often English, there is no specific statement that "the man with too weighty a burden, too heavy a load," must be an Englishman.

Masefield did not, then, begin his career with the avowed intention of being a national bard. His early prose studies, such as *Sea Life in Nelson's Time*, may have given impetus to a desire consciously and specifically to celebrate England and the English; thereafter, Masefield's work reveals his increasing preoccupation with English subjects. His first study of Shakespeare was followed by four narrative poems, *The Everlasting Mercy*, *The Widow in the Bye Street*, *Dauber*, and *The Daffodil Fields*, in which concern for the common man merged with love for the English countryside and England at sea.

Out of the war years came "August, 1914" and *Gallipoli*, and between 1919 and 1921 a poetic trilogy of English portraits, English pastimes, and the English countryside — *Reynard the Fox*, *Right Royal*, and *King Cole*.

Had Masefield died in 1921, he would have ranked as one of the great interpreters of English life and landscape. The three decades that followed, however, were to be filled with further celebrations of England. The Arthurian tales and several novels of the English countryside and Englishmen at sea were still unwritten; the poet had not yet fully acknowledged his debt to earlier English poets; another war lay ahead with English deeds to be recorded and English courage to be praised.

The appointment in 1930 to the Laureateship constituted no turning point in Masefield's career and did not influence appreciably the course of his writing; the work of later years was but the work of ornamentation and completion.

The Englishness of Masefield's work is the heart of it. If the prose and poetry which are characteristically English are separated from the rest of his work, little of major importance remains. The greater body of Masefield's work, and the finest part of it, is that in which he portrays and interprets



English landscape and English life. In this England of Masfield, John Bull sometimes makes an appearance, but always he is countered by St. George. And the spirit of St. George shines brightest in those longer poems and tales which are most likely to live.

There is no inconsistency in Masfield's apparent shift from a consecration to the common man to a consecration to England. His England is the England of the common man; and the beauties of that England of the future for which he calls repeatedly in his later work, are dedicated for the refreshment and the recreation of the common man in England and throughout the world. The new English theatre, for which he pleads in a recent essay, is but one of the agents Masfield invokes for the moving of "the world with the glory of the English spirit that is now the one thing left to us."

Microfilm copy of complete manuscript of 504 pages, \$6.30. Enlargements 6" x 8", 10¢ per page.

**PO CHÜ-I AS A CENSOR:  
HIS MEMORIALS PRESENTED TO  
HSIEN-TSUNG DURING THE YEARS 808-810**

(Publication No. 3885)

Eugene Feifel, Ph.D.  
Columbia University, 1952

Po Chü-i (A.D. 772-846), long famous for his poetry, is less known as an official. The present dissertation deals with some twenty memorials, or letters, addressed to the emperor Hsien-tsung (r.806-820) in Po's capacity as an imperial censor, one of the many offices he held during his lifetime.

The Introduction outlines the general organization of the various Court offices to which Po frequently refers. Special attention has been given to the office of censors. In Part One the background of each of Po's memorials is outlined, together with its immediate occasion and the personalities involved. Part Two includes a complete translation of these memorials with notes required for an understanding of the text itself.

A summary of the subject matter of Po's memorials will show that they covered the most important problems which plagued the T'ang dynasty in its later years and helped to bring about its downfall.

First, Po discussed the provincial military governors, especially those in the region north of the Huangho, who tried to secure for their families hereditary succession to governorship and who defied any imperial order aimed at breaking such a succession. They ruled like ancient feudal lords, governing and taxing their territories as they pleased. Others curried favor with the emperor, with the eunuchs, and with Court officials by presenting substantial gifts in order to pave their ways to high offices. Po Chü-i denounced these governors for their arbitrary rule and illegal taxation; he protested against the acceptance of their gifts and against the appointment of such officials to high Court offices.

Second, Po decried the ever increasing influence of the eunuchs upon Court and central government. With the approval and even with the help of short-sighted emperors the eunuchs not only succeeded in usurping much of the civil power but also the military leadership in times of peace as well as in war. Po tried to convince the emperor that the power which the eunuchs enjoyed was already unprecedented and that he should reduce it instead of increasing it. He specifically criticized the appointment of T'u-t'u Ch'eng-ts'ui as supreme commander of some ten armies fighting against Wan Ch'eng-tsung, a rebellious governor in Hopei.

Third, in several memorials Po presented a sad picture of the rural population of his time, how they were ruthlessly exploited by illegal taxation, how they were left in utter distress at the time of a prolonged drought, how they were pressed to pay their taxes in cash, although there was an acute shortage of coins due to some malpractices of merchants and of wealthy people. The memorial on ho-ti, or purchase of grain from the farmers by the government after mutual consent upon price, is regarded as one of the most important documents on the subject.

Po's memorials are naturally not systematic treatises on the history of his time. Nevertheless, they offer an illuminating cross-section of the political events of these years and show how far-sighted men like Po were fully aware of the abuses and evils prevailing in the empire, and how they recognized these evils as forces undermining the strength of the dynasty.

Microfilm copy of complete manuscript of 407 pages, \$5.09. Enlargements 6" x 8", 10¢ per page.

**THE GROWTH OF THE MEIJI NOVEL**

(Publication No. 3882)

Horace Ziegler Feldman, Ph.D.  
Columbia University, 1952

Shortly after Japan's seclusion had been breached by Perry, the Japanese exhibited varying reactions to the manifestations of Western civilization. In the field of literature, translations of Western works were extremely popular in the first decade of the Meiji period (1868-1912). Western-style newspapers also were soon developed. Both were of extreme importance in aiding early efforts toward a non-traditional novel.

After the enthusiastic but often abortive attempts of the political novelists, Tsubouchi Shōyō 坪内逍遙 sought to codify Western literary theories in 1885 with *Shōsetsu shinzui* 小説神髓 (The essence of a novel). In an atmosphere of growing interest in these precepts, Futabatei Shimei 浮城四迷 became the first author to implement them successfully with his novel *Ukigumo* 浮雲 (Floating clouds) in 1887.

Almost immediately, however, there occurred a brief reaction against Western influence. From 1888 to 1893, the leading novelists imitated the ornate style

and bizarre plots of pre-Meiji prose. They were the literary representatives of the kokusui 国粋 (national essence) revival.

Thereafter, in the decade prior to the Russo-Japanese war, Takayama Chogyū 高山樗牛, politician, literary critic, and leader of the Nihon shugi 日本主義 (Japanism) movement, presented the strongest advocacy of the traditional in Japanese life and culture. Among significant creative writing in this decade, however, only the tragic novels of Hirotsu Ryūrō 廣津柳浪 were reminiscent of the past. Tokutomi Roka 徳富蘆花, while not a contributor to the new trend, also avoided the old pattern in his domestic novels, and authors such as Izumi Kyōka 泉鏡花 and Kawakami Bizan 川上眉山, whose novels superficially resemble those of Hirotsu, actually represent the beginnings of romanticism.

In the last years of the nineteenth century, the romantic movement was strengthened by the efforts of Mori Ogai 森鷗外, who had begun his campaign during the kokusui reaction, and the initial endeavors of the young potes, headed by Kitamura Tōkoku 北村透谷, who published the Bungakkai 文藝界. Kunikida Doppo's 國木田獨步

Gen oji 源也子 (Uncle Gen), which appeared in 1897, was perhaps the best of the romantic novels.

The pivot in the novel at this point is well shown by Ozaki Kōyō 尾崎紅葉. After his very popular imitation of pre-Meiji romances in his earlier years, Ozaki now declared his preference for the modern novel and again enjoyed considerable success. The best prose works toward the close of the century, however, were written by Higuchi Ichiyō 樋口一葉, an alumna of the Bungakkai group. Ichiyō had read and discussed Western literature but she was not an imitator. Her novelettes are a faithful and sympathetic reproduction of the lives of the young people among whom she lived.

A more strict realism then developed. The principle of naturalism in the novel was put forth by Kosugi Tengai 小杉天外 and Nagai Kafū 永井荷風 at the turn of the century. Implementation of this credo then began with the second stage in the literary careers of Kunikida Doppo and Futabatei Shimei, and reached fruition in the works of Tayama Katai 田山花袋 and Shimazaki Tōson 島崎藤村.

Tyama's Futon 蒲団 (Bedding), which in 1907 described the unhealthy sexual desires of its crumbling protagonist, is the chief example of unrelieved naturalism. A year earlier Shimazaki had presented in Hakai 破戒 (The infraction) a carefully detailed sympathetic portrayal of the problems of an outcast. The stage was then set for a more mature modern novel as the Meiji period drew to a close.

## THE LIFE OF APULEIUS AND HIS CONNECTION WITH MAGIC

(Publication No. 3890)

Cecil Paige Golann, Ph.D.  
Columbia University, 1952

The Metamorphoses of Apuleius is often regarded as a heterogeneous collection of questionable stories with a religious ending added for some inexplicable reason. An analysis of this novel, however, reveals more unity and more careful planning than is usually realized.

Since Apuleius' novel appears to be an adaptation of a lost Greek work, it is important to determine what is original with Apuleius and what stems from his model, the lost Μεταμορφώσεις. It is suggested that I, 3, 4, and 20; II, 18, 31, and 32; and III, 1-18 are Apuleius' own contributions and were not, as some think, in the lost Μεταμορφώσεις.

The purpose of the original magical episodes in the first three books apparently is to convince the reader that magic is possible in order to make credible Lucius' metamorphosis into an ass by magic. If one cannot accept this as possible, how can one take seriously Lucius' restoration to human shape through Isis' providence and regard it as a proof of Isis' power? In Book XI, Isis' devotees interpret what happens as a miracle.

After Lucius' transformation, the mood changes from the comparative gaiety of the early books (which also have their sombre moments). Various ordeals, tragic events, and accounts of vice are depicted with ever-increasing intensity and little comic relief until one comes upon the depths of human degradation in Book X. The novel can be shown to be a serious work on the whole since less than a fifth of the episodes are diverting.

The events in I-X prepare Lucius for his moral regeneration and salvation in XI. One can say that the wretchedness of existence before conversion to the Isis cult is shown in I-X in contrast to the bliss and security that follow conversion, depicted in XI. Book XI reveals the completely different world, which is the possession of the devotees of Isis.

Since Apuleius is admittedly the first Latin author in whose works magic is so dominant an element, one is tempted to explain why this is so. In the Metamorphoses, and Apology, and the De Deo Socratis, there is evidence that Apuleius actually believed in magic, as did many educated people of his time.

It is suggested in this study that one does not have to look any further than Apuleius' background to explain not only his interest in magic but also his religious outlook, consisting of fanatical self-abasement, humble submission to the divine will, and an acceptance of priestly domination. These were all typical features of Punic Africa, whence Apuleius came. A brief sketch of magic in North Africa, Egypt, and the Orient as well as in Greece and Rome seems to support this theory that the predominance of magic in Apuleius' work is best explained as resulting from his North African background and travels in the East. Considered as a product of the Graeco-Roman world,



he is indeed an anomaly or a paradox. But none of his characteristics that have caused so much surprise and comment would appear strange in a writer from North Africa or the Orient.

Did Apuleius deserve the reputation of *magus* he subsequently acquired? Several scholars have already suggested that Apuleius practised magic. If any contribution to this still disputed point has been made in this study, it consists of some additions to the evidence of others. It should be said, however, that Apuleius was probably innocent of the accusation that he used magic to win his wife.

Lastly, it may be said that there is evidence to justify revising the generally accepted chronology of the life of Apuleius. This evidence is presented both in the text and in an Appendix to support the new dates suggested.

Microfilm copy of complete manuscript of 191 pages, \$2.39. Enlargements 6" x 8", 10¢ per page.

#### THE AMERICAN SCENE IN FRIEDRICH GERSTÄCKER'S WORKS OF FICTION

(Publication No. 3949)

Bjarne Emil Landa, Ph.D.  
University of Minnesota, 1952

The American scene presented in Friedrich Gerstäcker's works of fiction is based on the author's own observation during his three sojourns in the United States. After reading his diary and books of travels dealing with this country, one is constantly impressed by the close parallelism between firsthand recordings and their adaptations in succeeding works.

A devotee of nature, Gerstäcker offers us a number of vivid descriptions of the American landscape, its flora, and fauna, showing his intimate familiarity with the subject matter. His landscape descriptions fall into three categories. The one least frequently applied comprises mostly larger areas, such as a combination of several states, or large segments of individual states and regions. They familiarize the reader with the general topographic and geographic characteristics of the areas concerned. A landscape description employed more frequently by Gerstäcker covers fairly well defined areas and serves to characterize with precision locations in which subsequent fictional scenes of action are to be placed. The type most used pertains to an area which can be seen only through the eyes of the fictional characters themselves at a specific time and from a particular point of view.

Areas visited and described by Gerstäcker are located mostly in the South, Southwest, Middle West, and northern California, such as sections of the primeval forest in Arkansas, Missouri, and Tennessee; the lower Mississippi river, its approaches, and tributaries, especially the Arkansas and the Ohio with surroundings; the Ozark Mountains; prairies in Illinois, Nebraska, and Kansas; the San Francisco Bay area, and the inland mining region.

Gerstäcker's portrayal of animals and birds in the United States is given from the standpoint of an enthusiastic huntsman. Relevant information is conveyed in three ways: The author may address himself directly to the reader; fictional characters relate their own observations and experiences in regard to game and fowl; and the reader is given the opportunity to witness fictional scenes in which animals and birds are involved.

Gerstäcker presents the people of the United States as heterogeneous, showing marked awareness of differences as to race, color, and origin. Thus, in regard to native Americans, he distinguishes between the Caucasian majority and the minor groups of Negroes and Indians. He even classifies the Caucasians according to mental disposition, occupation, and location, viz., the backwoodsmen of the Southwest, the planters of the South, and the Yankees of the East. Among the latter groups the backwoodspeople — their attitude, manners, and customs — receive most of the author's attention. He is best acquainted with these people, favorably disposed toward them, and appears to enjoy describing their rather primitive way of life. The southern planters, on the other hand, do not meet with the author's approval. They are depicted as arrogant, ruthless despots living luxuriously on the fruits of the labor exacted from defenseless slaves. The Yankee's ingenuity and persistence in business are stressed, as well as his lack of positive ethical and aesthetical standards.

Besides segregating Americans into types as to occupational interest and social attitude, Gerstäcker considers them as a whole, with their particular political, social, economic, educational, and religious institutions and organizations. The American is pictured as harboring a deep devotion to liberty. He is industrious, ingenious, persevering, courageous, and patriotic. But he is also presented as excessively materialistic, with little or no sense for spiritual values.

The minor racial groups, the Negroes and the Indians, are presented primarily as the unfortunate victims of the whites. The inhuman cruelty inflicted on the Negro as a slave and his difficulty in attaining equality after liberation are emphasized. Gerstäcker's Indian is divested of all traditional romantic attributes, mostly the victim of the white man's deceit and insatiable greed for more land and power, wherever the two races come in contact.

Gerstäcker, a staunch Young-German patriot, identifying himself as a German throughout his writing, naturally shows the greatest interest in his compatriots among the foreigners in America. Germans predominate to such an extent that other foreign nationals are comparatively little in evidence. In fact, the vision of America rendered in Gerstäcker's fiction is obtained principally through the medium of German immigrants. As far as the immigrant is concerned, his success or failure in the new country depends entirely on his own industry and adaptability.

Microfilm copy of complete manuscript of 319 pages, \$3.99. Enlargements 6" x 8", 10¢ per page.

CHARLES CHURCHILL  
AS A POLITICAL WRITER

(Publication No. 3844)

Dwight Augustus Lee, Ph.D.  
University of Missouri, 1952

This study is an attempt to determine the political significance of the writings of Charles Churchill. It contains as background material a summary of the political events in England from 1742 to 1770 and short summaries of the lives of Churchill and John Wilkes to the beginning of their partnership on The North Briton in June, 1762. All available documentary evidence is cited, and the probable authorship of the remainder of the forty-five issues is established through the study of internal evidence. The results of the study of authorship indicate that Churchill wrote at least ten issues of the magazine and contributed substantial portions of at least five more. Although Churchill apparently was in full partnership with Wilkes in producing The North Briton, he has seldom been given credit for its political success.

The political satire in Churchill's poetry is discussed under selected subject matter rather than poem by poem. These subjects are grouped into three main divisions: the Lord Bute ministry and its supporters, the institutions and groups which Churchill thought were hostile to English constitutional liberties, and a selection of the chief political leaders who led the attack on Wilkes. Evidence indicates that although Churchill was often motivated by personal loyalties and animosities he was intensely interested in protecting and extending English constitutional liberties.

The study concludes that Churchill was of the first importance as a political writer during the short time from June 5, 1762 (the beginning of The North Briton), until his death on November 4, 1764. The facts that Churchill died so early in his career as a political writer and that Wilkes was arrested on a charge of libel and thus in the eyes of the middle and lower classes became the champion of liberty explain why public attention became focused on Wilkes and Churchill's political importance was almost entirely forgotten.

Microfilm copy of complete manuscript of 207 pages, \$2.59. Enlargements 6" x 8", 10¢ per page.

CATO THE ELDER: AN INTERPRETATION

(Publication No. 3934)

Elsie Lewis Leeman, Ph.D.  
Columbia University, 1952

The personality of the vigorous and vital Cato the Elder (234-149 B.C.) has been distorted by contradictions and confusions in the literary tradition. A true appreciation of the man cannot be reached without discerning the misapprehensions and politi-

cal bias of our sources as well as understanding the real motives that guided Cato in his actions. It becomes clear from a study of the sources from Polybius to Plutarch that there are four main aspects of Cato's personality which have been subject to confusion; namely, his attitude towards the Scipios, his attitude toward Carthage, his moral nature, and his views on Greek culture.

In order to understand Cato's attitude towards the Scipios, the basic fact that there was hostility between them may be accepted, though we may question the truth of many of the details of this hostility, especially those stemming from the sensationalized and biased History of Valerius Antias. Investigation shows, however, that this enmity was not due to an unreasoning pettiness on Cato's part; rather did it have its roots in Cato's abhorrence of that superbia of Scipio Africanus which he saw as a possible threat to the established government. Added to this was Cato's disapproval of Scipio's interest in Eastern politics which was leading to the neglect of Italian culture as well as to deterioration in Roman morality and general foreign policy. Cato's final prosecution of the Scipios in 187-184 was not a special case, but merely another instance of his attacks on those generals whose honesty in their Eastern campaigns had come into question.

Cato's hatred for Carthage, presented first by Poseidonius in the well-known (and perhaps spurious) Cato-Nasica debate, puts Cato in no less an unflattering light than his enmity for the Scipios. Investigation of Cato's general foreign policy, however, shows an insistence on honest diplomatic negotiations and fair treatment of Rome's allies. At no time in his life did he favor imperialism. By 150, however, in view of Rome's internal degeneration and the deterioration of her foreign relations, he came to feel that mildness of rule and the so-called healthy emulation of states which he had previously advocated, was a mistake and that Rome could best secure her safety and the peace of the world by completely crushing her enemies and binding her subjects with bonds of might. His demand for the destruction of Carthage was in line with this new policy and was motivated by genuine fear of a powerful and treacherous nation and concern for the welfare of Rome.

This same concern motivated Cato's war against vice also. This war too did not spring from mere political ambition, nor from mere puritanism of spirit, as one might suspect from the exaggerated portrait of Cato the Censor painted by Livy and Plutarch. It was a struggle undertaken against avarice and luxury, the two great evils which he saw as the most serious threats to the state. How wise and discerning Cato was in attacking these vices may be seen from the adoption of his luxuria-avaritia theory by subsequent generations.

Cato's concern for the state goes far towards explaining his feeling towards things Greek. While it is true that Cato was an anti-Hellenist, it may still be said that tradition has not been fair in exaggerating his hostility. He did have an appreciation of Greek culture based on a knowledge acquired not in his old age, as Cicero would have us believe, but in his



middle years, at least. His antagonism was not directed towards the culture in general, but towards the vices it bred in its degenerate form. He objected to immorality, dishonesty, deceptive subtleties, bombast, and the neglect of Roman culture leading to the submergence of native and national traits in a foreign culture. Here too we see Cato's supreme devotion to Roman Italy; understanding that this devotion guided all his actions makes his character more intelligible to us and excuses to a certain extent the extreme measures he sometimes took in salutem Rei Publicae.

Microfilm copy of complete manuscript of 220 pages, \$2.75. Enlargements 6" x 8", 10¢ per page.

#### STASIS AND DYNAMIS: TWO MODES OF THE LITERARY IMAGINATION

(Publication No. 3903)

Allen Mandelbaum, Ph.D.  
Columbia University, 1951

The first part of this work, "Dynamics," elucidates and defends the dramatic Many as opposed to the static One, the poetic as opposed to the dogmatic, in the lyric. The points-of-origin are the work of Crashaw, chiefly his "Epiphanie," and of Hopkins. Earlier linkings between the two are briefly examined in Chapter One. Chapter Two consists of a detailed reading of Crashaw's "Epiphanie," a reading that leads to Hopkins in the following chapter, and a poetic valid for both Crashaw and Hopkins in Chapter Four. That poetic, called Anti-Cathartic, i.e., intent on drama and complexity rather than on resolution, on dynamis as distinct from stasis, is "vindicated" in Chapter Five, "The Critics on Catharsis," and used as an instrument of description and evaluation for a group of selected lyrics in "The Ego and Dynamis," the final chapter of Part One.

This "dynamic" background, centered on the lyric, forms the conceptual base for the examination in Part Two, of tendencies towards either formal or ideological stasis in the modern novel and poetic drama. But beneath the more complex aspects of ego-material relations in narrative and drama, elements that may be dynamic in the lyric become static. The vehicles for this stasis are seen as: the belief-form of the modern artist, myth, defined in Chapter Seven; the specific Myth of the Artist (Mann and Joyce), examined in Chapters Eight and Nine; and the lyric-focussed drama (Joyce, Yeats, Eliot), the concern of the final chapter. The work, in that last chapter, that serves as a touchstone for a possible break-through, though certainly a modest one, to dynamis, is T. S. Eliot's The Cocktail Party. A study of the response to that play by its New York audience forms the contents of the appendix.

Microfilm copy of complete manuscript of 282 pages, \$3.53. Enlargements 6" x 8", 10¢ per page.

#### FORMEY AND THE ENLIGHTENMENT

(Publication No. 3904)

Eva Dorothea Marcu, Ph.D.  
Columbia University, 1952

Although his name frequently appears in studies pertaining to the European Enlightenment, Jean-Henri-Samuel Formey has not yet been subjected to the comprehensive study his place in the history of ideas would seem to merit. A son of Huguenot refugees, and born in Berlin, he was not only pastor of the Protestant Temple of that city and professor of philosophy at the French College, but also a distinguished leader of the French colony. Moreover, he attained prominence as historiographer and perpetual secretary of the Prussian Academy and became a prolific and widely-read writer on contemporary philosophical and moral subjects.

On the one hand, Formey represents that intellectual spirit of an eighteenth-century Germany inclined towards the metaphysics of Leibniz in its Wolfian systematization which was, for half a century, the nation's ruling philosophy. On the other hand, his writing zeal and his manifold intellectual interests brought him into close relationship with the French philosophes for whom his king, Frederick II, long showed such strong partiality. Formey's views on the great figures of the French Enlightenment are of interest in that he did not see France through the eyes of a native-born Frenchman, or as a complete alien, but rather through the displaced perspective of a writer who, while of French blood and steeped in the French tradition, had lived out his life in another country.

Having begun a philosophical dictionary in 1742, Formey made his first contact with French intellectual leaders when, in 1747, he offered the directors of the newly projected Encyclopédie some 1800 pages of his own manuscript. The proposal was accepted and approximately eighty of his articles were to appear in the celebrated work.

From this time on his relations with individual French writers became more pronounced. But his personal and intellectual contacts were complicated by his attempt to achieve some kind of balance between the spirit of enlightenment and the Christian tradition. It was inevitable that the ideological developments from without, especially from France, should upset the equilibrium he wished to effect, and Formey finally took the easier path of defending throne and altar. His attacks on D'Alembert, who, as a guest of the Prussian court, he had come to know personally, were delayed until after the death of both Frederick and D'Alembert. Attempts to refute Diderot's Pensées philosophiques and Lettre sur les aveugles were presented around the middle of the century in two works: Pensées raisonnables, opposées aux Pensées philosophiques and the Lettre de M. Gervaise Holmes à l'auteur de la Lettre sur les aveugles. Diderot, however, was to be almost neglected thereafter.

It was Rousseau, and even more Voltaire, who were to be the stumbling-blocks in Formey's life.

As the spiritual atmosphere became increasingly tense, all the traditionally inclined minds were aroused. Rousseau was the object of repeated attacks in Formey's discourses for the Academy and was particularly refuted in the *Anti-Emile* and the *Emile chrétien*. Formey felt incapable of fighting openly such a formidable opponent as Voltaire and, despite great differences of opinion and personality, was able to maintain as long as Voltaire lived, a pretense of quasi-friendliness. His antipathy remained buried in letters to friends and became public in Formey's *Souvenirs d'un citoyen*, published long after Voltaire's death.

In the final analysis, Formey seems to represent a recurrent phenomenon in times of great decision: a man who strives intelligently to understand the world, to find a resting place amidst the turmoil but who, soon surpassed by swiftly moving events and more purposeful minds, tries to react with insufficient means and is finally swept aside.

Microfilm copy of complete manuscript of 161 pages, \$2.01. Enlargements 6" x 8", 10¢ per page.

#### RELIGION AND WILLIAM BUTLER YEATS

(Publication No. 3907)

Virginia Moore, Ph.D.  
Columbia University, 1952

This book traces the doctrinal development of the great writer William Butler Yeats (1865-1939) from childhood, when belief in the supernatural awakened, to his death at nearly seventy-four, when the supernatural seemed to him proved; the stress — since his religious concern deepened with maturity — being on the last thirty-seven years. Because religion grows out of life and applies back to life, it was deemed absolutely necessary to treat the subject semi-biographically. Only so could one avoid abstraction.

Chapter I sums up the almost bewildering variety of opinions as to Yeats' religion on the part of perspicacious critics; and sets the general problem.

Since in his thirty-seventh year (the exact middle of his life) Yeats suffered a shock so severe it radically changed his thinking and acting, Chapter II tries to discover what happened that February night — while at the same time underscoring his essential religiousness — by tracing his development up to that event largely in religious terms: childhood, youth, young manhood.

The mainsprings of Yeats' thought being already apparent, Chapters III, IV and V pause to take up in detail Druidism, Blake, and Hermetism, respectively, as major doctrinal influences; endeavoring in all three cases to track down his sources; and endeavoring, also, to show that, in respect to a central belief in "correspondence," these influences belong to one single ancient tradition. Heretofore, in writings about Yeats, such matters have been only barely mentioned, never investigated.

Chapter VI considers in detail Yeats' experience as a member for over twenty-five years of the Order of the Golden Dawn, a so-called Hermetic and Rosicrucian society, and one which he himself has said "isolated and shaped" him. This is all new material.

While covering his life roughly from 1903 to 1910, Chapter VII concentrates upon his doctrine of mask as it emerged from his theory of progress through opposition and conflict: a matter intimately tied up with the tradition previously explored.

Chapter VIII (while covering his life roughly from 1910 to 1917) deals with his spiritistic investigations as dogged search for a proof of immortality demonstrable to everyone; and notes first his disappointment in the results, and then his astonishment when his own wife, turning medium, gave forth a "system" mirroring his own ideas and purporting to explain the whole of life.

Chapter IX (while covering the period roughly from 1917 to 1925) analyzes that system as embodied in Yeats' book *A Vision*; giving particular attention to his Great Wheel as a classification of human types, and to his Double Cones as universal pattern of development for both individuals and history.

The Great Wheel having raised the question of the relation between subjectivity and objectivity, Chapter X discusses Yeats' friendships insofar as they were a "school" for understanding that relation, and helped him, eventually, to see love as a subjective-objective reconciliation.

Chapter XI, looking back over the years between 1925 and 1935, examines in greater detail his study of first Western and then Eastern philosophy: his "test" for *A Vision*; and then notes how that disciplinary study influenced the second edition. This whole matter is here investigated for the first time.

After a lifetime of activity in literature, politics and the theatre, as well as of study, Yeats had now reached seventy-two and his health was failing.

Chapter XII (while covering his last year and a half) examines in retrospect his lifelong relation to the Protestantism into which he was born, with special reference to the six matters which keep some critics (not all) from naming him Christian. Without attempting to judge, it points out certain facts and relations.

The last chapter, XIII, sums up the final convictions of a man who, hungering for ultimates, could not rest until he had a world-conception; and describes his last weeks and philosophy-sustained death.

Microfilm copy of complete manuscript of 619 pages, \$7.74. Enlargements 6" x 8", 10¢ per page.



**THE BACKGROUND OF SPENSER'S  
PROTHALAMION**

(Publication No. 3018)

Dan S. Norton, Ph.D.  
Princeton University, 1940

Abstract not available.

Microfilm copy of complete manuscript of 256 pages, \$3.20. Enlargements 6" x 8", 10¢ per page.

**VOL. I. RICHARD JOHNSON AND THE SEVEN  
CHAMPIONS OF CHRISTENDOM (1596 and 1597)  
MATERIALS FOR AN EDITION OF HIS WORKS.  
VOL. 2. THE SEVEN CHAMPIONS OF  
CHRISTENDOM PART I BY RICHARD  
JOHNSON TRANSCRIBED FROM THE EDITION  
OF 1626?**

(Publication No. 3030)

David Allan Robertson, Jr., Ph.D.  
Princeton University, 1940

Abstract not available.

Microfilm copy of complete manuscript of 588 pages, \$7.35. Enlargements 6" x 8", 10¢ per page.

**THE HOUSE THAT JACK BUILT: A STUDY  
OF JACK LONDON: THE MAN,  
HIS TIMES, AND HIS WORKS**

(Publication No. 3914)

Abraham Alan Rothberg, Ph.D.  
Columbia University, 1952

For a long time a myth has surrounded Jack London and his work and the myth has been accepted and become canonical. *The House That Jack Built* attempts to analyze the myth about the man and his work, and attempts to disentangle fact from fantasy. London's work is so personal, so much of it arising out of the circumstances of his own life, that criticism of his work demands a specific and detailed reference to the life and personality that lay behind it, and his work is treated in this light. This revaluation of London stresses the development of contradictory forces in him by his early years, family life, and native temperament. London's poverty and illegitimacy made him feel like an "outlaw," and much of his later love of violence and egocentricity are compensations for and results of these factors. His racism and blond beast superman are also compensations for shabby family origins and additional ways of expressing his hatred of the world and his need for dominating it. London's often reiterated allegiance to socialism, arising from his own social and economic position as declassed bourgeoisie, was undermined by his individualist leanings and his urge to escape

the cellar of society by self-assertion, so that his sympathy for the common people was tinged by the contempt aroused by his own middle-class aspirations. With each success of his life and work, he moved further away from the people and his sympathy for them.

London was a man of his time, and the contradictions of his era were embodied in his life and work, and his inability to resolve these contradictions led eventually to his intellectual and physical suicide. The influence on London of the close of the frontier, naturalism, socialism, social Darwinism, racism, imperialism, nineteenth century romanticism and twentieth century realism, and the most important problem in his life and work, his simultaneous allegiance to an idealist-socialist position and a materialist-individualist position, is examined in both the life and the works. London was not an intellectual nor a student, and he suffered from all the shortcomings of a temperament that would not permit the patience and reflection necessary for education. The sources to which he claimed he owed indebtedness — Marx, Darwin, Nietzsche, and Spencer — were actually far less important than what he absorbed from his socialist friends, Ouida's *Signa*, Kipling, and Benjamin Kidd, but his chief source was the material of his own life and temperament.

London's novels and short stories are examined in chronological order for part-whole relations, organic unity, characterization, prose style, recurring imagery, and the development and continuity of London's ideas.

Microfilm copy of complete manuscript of 408 pages, \$5.10. Enlargements 6" x 8", 10¢ per page.

**GASPARA STAMPA**

(Publication No. 3918)

Joseph Henry Satin, Ph.D.  
Columbia University, 1952

This dissertation deals with the life and poetry of Gaspara Stampa (1523-1554).

Gaspara Stampa was born in Padua but spent most of her years in Venice, and that city played a large part in shaping the course of her life. In the 16th century Venice had begun to decline. In place of its former military strength it substituted luxurious living. Despite the city's own efforts to curb extravagance and to return to its medieval austerity, Venetian pomp and luxury assumed fantastic proportions. Gaspara Stampa, fatherless at the age of eight, was captivated by this glittering life. With her brother, Baldassare, and her sister, Cassandra, she was caught up in a swift intellectual and social current. She studied poetry and music and mingled freely with Venetian artists and nobles. When she was twenty her poet-brother, Baldassare, died. Shortly after this her own career as a poet began, and she and Cassandra most probably became courtesans at this time. The lengthy controversy, extending into our own century, over whether Gaspara Stampa was really a courtesan seems to leave no doubt that she was. All the evidence, as presented here in this thesis, substantiates this fact.

Declining Venice had considerable respect for its most attractive, intelligent, and costly courtesans. They became known as *cortigiane oneste*. In many respects the *cortigiana onesta* resembled the *hetaira* of ancient Greece.

As a *cortigiana onesta* Gaspara Stampa made more illustrious friends and admirers, and gained fame as a musician and poet. When she was twenty-five, her most celebrated love affair began. Her lover, Collalto de Dollalto, was an eminent soldier, a captain who served under Orazio Farnese, as well as a nobleman. After several months Collalto left her and journeyed to France to help Henry II in his fight against the English. Gaspara Stampa's poems lamenting his absence brought her recognition as a truly gifted poet and increased the number of her important friends. A half year later Collalto returned to Gaspara Stampa. Then, with the coming of spring, he left for his castle in the Trevisan March. Gaspara mourned his departure briefly, then turned back to the applause and allurements of Venetian society. She never saw Collalto again.

At twenty-nine she wrote poems in celebration of another love affair, this time with Bartolomeo Zen, about whom nothing is known. The following year she went to Florence, where her brother had gone just before his death. About this time she wrote poems renouncing earthly love and imploring the love of God. Shortly after her return from Florence, while in the house of a Venetian nobleman, she fell ill and died.

The chief merits of her poetry are a passionate, intimate spontaneity and occasional lines of great power. In the words of one admiring critic, lines like hers had not been heard since Dante. Most of her poems describe her love affairs and her ultimate turn to God.

Included in this dissertation are fifty selected poems of Gaspara Stampa. They are translated into a prose which seeks to point up the tone and quality of the originals.

The dissertation concludes with a brief examination of the effect of the baroque style of Gaspara Stampa's work. Although she lived in decadent Venice at a time when baroque poetry was growing quite popular, she was only slightly affected by it.

Microfilm copy of complete manuscript of 217 pages, \$2.71. Enlargements 6" x 8", 10¢ per page.

WILLIAM BUTLER YEATS: HIS POETRY  
AND HIS VISION, 1914-1939

(Publication No. 3919)

Morton Irving Seiden, Ph.D.  
Columbia University, 1952

In 1925 William Butler Yeats published the essay *A Vision*, to which he referred as a myth, as a religion, and as a philosophy. Yeats was proud of this essay; and, although he had not begun to write it until 1919, he considered it a climax to an entire lifetime of intellectual development. However, since the publication of the book, because in his exposition he

is often cryptogrammic and too often relies on an archaic supernatural machinery, critics of his works have come to regard *A Vision* as a literary oddity. Yet in their studies of his works they have been concerned again and again to return to considerations of the book and to ask four very pertinent questions. What is he talking about? Where did he get his ideas from? Did he believe in the book and, if so, then in what way? What is the relationship, if any, between the book and his poetry? It is these same questions which, in my study of Yeats, I too attempt to answer.

But the study which I have made, so far as I have been able to determine, is unique. It is the only elaborate, systematic, and detailed study of *A Vision* and of the relationship between it and the bulk of Yeats' poems and other essays, his definitions of "mythology" and "belief," and his great preoccupation with Shelley's *Prometheus Unbound*, Blake's *Prophetic Books*, and both anthropological theory and occult lore. It represents the only comprehensive attempt, furthermore, to distinguish in *A Vision* between objective and metaphorical statements, fact and error, opinion and dispassionate wisdom, and implicit and explicit "levels of meaning." And I have emphasized, in my consideration of such problems, his almost exaggerated interest in philosophical symbolism and literary archetypes, dreams and the unconscious, primitive myths and legends of Graeco-Roman civilization, and the relationship between all these and creative work in art.

Finally, in the book which I have written I have endeavored both to correct popular misconceptions about Yeats and to give, in the light of *A Vision*, detailed exegeses of the poems and plays he wrote during the last twenty-five years of his life. The most common of the misconceptions is concerned with his treatment of the supernatural, to which the critics of his works have thought he naively gave an external reality. It is my purpose to demonstrate that, so far as he was concerned, *A Vision* is a psychological drama and that in this drama his ghosts and spirits of his doctrine of cycles and antinomies symbolize or describe states of the human mind. My exegeses, which I make almost entirely on the basis of *A Vision*, help not only to clarify the most obscure passages in his later poetry but also to reveal their great depth of meaning. Also, and to this matter I give particular emphasis, the careful studies I have made of his later poems reveal a great number of abstruse themes in which Yeats appears to have been very much interested but which heretofore have been completely ignored, perhaps because they have never been even recognized, by other critics of his works. The most important of these themes, to illustrate, is one which states that the universe is involved in a process of perpetual decay.

It is perhaps true that I give an exaggerated importance to *A Vision* in my analyses of Yeats' thought and his poetry. However, unlike T. S. Eliot and I. A. Richards, who look with complete disfavor on the book, I cannot but think that it was mainly through the writing of *A Vision* that Yeats helped himself to become, what as a young man he was not, one of the major poets in English literature.

Microfilm copy of complete manuscript of 425 pages, \$5.31. Enlargements 6" x 8", 10¢ per page.



## THE YOUNG ENGLAND MOVEMENT

(Publication No. 3691)

Paul Smith, Ph.D.  
Columbia University, 1951

To enlist the informative and humanizing powers of literature in the service of politics was the objective of a group of young Tories in the 1840's who called themselves the "Young Englanders." Led by Benjamin Disraeli, the group included George Sydney Smythe, Lord John Manners, Alexander Baillie-Cochrane, and about a dozen less important M.P.'s. Sympathizers inside and outside of Parliament lent valuable support to this nucleus.

Convinced that both political parties were corrupt, and that the nation had reached a dangerous state and was possibly on the brink of revolution, the Young England men took as their chief specific aims the restoration of harmonious class relations, improvement of the condition of the lower classes, a revival of interest in England's glorious history (particularly the Middle Ages), strengthening of the monarchy and of the Church and of other English institutions. Increasing the number of social institutions like public parks, playgrounds, and libraries was also advocated.

The literature in which these aims were discussed consisted of three novels by Disraeli (*Coningsby*, 1844, the first political novel, *Sybil*, 1845, and *Tancred*, 1847); two volumes of poetry (*England's Trust*, 1841, and *English Ballads*, 1850) and a pamphlet (*A Plea for National Holy-Days*, 1842) by Manners; *Historic Fancies*, 1844, a mélange of poetry and prose, by Smythe; and *Who Are the Liberals?*, 1852, by Cochrane. Long after the Young England group had disintegrated, its former members continued to write about it. Disraeli's *Preface to Lothair*, 1870, and Cochrane's *In the Days of the Dandies* (1890) are summaries of the movement.

Young England had satirists and even enemies, as well as sympathizers and allies. Expressions of disapproval, ranging from playful humor to venomous attacks, appeared from the pens of Thackeray (*Codlingsby* and a passage in *Novels by Eminent Hands*), Christopher North (Professor Wilson), who wrote a two volume satire called *Anti-Coningsby*, Peacock (sections of *Crotchet Castle* and *Gryll Grange*), Trollope (sections of *Barchester Towers*), Kingsley (a chapter in *Yeast* which contains some favorable criticism, also), Milnes, Serjeant Murphy and many others. Numerous brief references are to be found in other nineteenth and twentieth century literature; for example, in the *Communist Manifesto*.

Politically, Young England enjoyed considerable prestige and influence in the 1840's, when its writings and speeches helped to create public opinion and to get social legislation passed. The Maynooth Bill of 1845 and the Corn Law Repeal Bill of 1846 broke up the movement; but when Disraeli became Prime Minister in the 1870's, he accomplished much of the program advocated by Young England in the 1840's. The Fourth Party carried on Young England's Tory Democracy after Disraeli's death, and the Primrose

League, invented by one of the founders of the Fourth Party, and including among its members Lord John Manners, thrived from 1883 to 1906. Numerous twentieth century references to the Young Englanders and their ideas, and such events as the Festival of Britain (1951) prove that the movement is still alive.

Microfilm copy of complete manuscript of 241 pages, \$3.01. Enlargements 6" x 8", 10¢ per page.

WILLIAM BLAKE & D. H. LAWRENCE:  
A COMPARATIVE STUDY IN THE  
SIMILARITY OF THEIR THOUGHT

(Publication No. 3666)

Constantine Nicholas Stavrou, Ph.D.  
University of Buffalo, 1952

The aims of this study are two-fold: first, to examine the works of William Blake and D. H. Lawrence in the light of their anti-rationalism; and second, to show by comparison the similarity of their thought. To this end detailed analyses of their poems, letters and (in the case of Lawrence) essays, novels, and short stories are made. Their 'message' to mankind is shown to have been essentially one and the same — a fervid philippic against the pharisaic mores of our Prufrockian society, concomitant with a plea for the emancipation of the senses and the imagination from their bondage to an enervating and effete intellectualism. That there are issues upon which they never would have concurred goes without saying. What is more, it must be confessed, in all honesty, that the influence of Blake on Lawrence cannot be absolutely measured. In many instances, it is impossible to determine to what extent those ideas of Lawrence that are so amazingly similar to those of Blake are the result of conscious borrowing, unconscious recall or pure coincidence. Lawrence, unfortunately, seldom vouchsafes to say. Yet, there can be no denying that if we allow for the differences in their personal make-up and the periods in which they lived, their 'vision' of man and the universe is strikingly the same. In any case, I feel that the similarities between them are so numerous and significant as to warrant their being coupled in this study.

Blake proclaimed the doctrine of the sacred self. He taught that all deities reside in the human breast and insisted that imagination and impulse were the only true guides into Eternity. His constant plea was for a reaffirmation of the intuitive life, the life of joy and energy. Blake's Christ was made over in his own image as seer and rebel, the incarnation not of humility but of vitality. In the Blakean cosmos Christ is the avowed castigator of restraint and the moral code. His antagonist is Blake's arch villain, Urizen (Scientific Reason), whose high-priests are Bacon, Newton and Locke. And this latter triumvirate is, in turn, opposed by the true prophets, Chaucer, Shakespeare, and Milton — collectively, true poetic genius. Blake abhorred the scientific rationalism and the secular religion which explained, in mechanistic terms, the

mysteries of life and the cosmos. He anathematized factories as Satanic Mills, and reviled sexual restraint as pestilential. He inverted the conventional notions of good and evil and anticipated Freud's ideas on repression and Jung's ideas on the collective subconscious.

This spirit of rebellion, which led Blake to defy many of the settled criteria, mores, and faiths of convention-ridden society, was also strongly operative in D. H. Lawrence. He shared Blake's hatred for intellectual preciousness, science, and a mechanized civilization. Lawrence, too, deprecated the exaltation of the intellect at the expense of instinct and impulse. He, also, preached the primacy of desire and was not ashamed to affirm the divinity of the human body. Bursting with apocalyptic fervor upon the so-called Waste-Landers, Lawrence sought to give back civilized man the force of his primitive instincts, wherein, he believed, lay the sources of vitalism and joy. Like Blake before him, he perceived that the psychic disease of modern men and women was the atrophied condition of the intuitive faculties. His vision was Blake's vision, the vision of each man as the macrocosm within himself. His Christ was Blake's Christ, reborn only through the mystery of 'touch.' Comparable to Blake's esoteric mythology of the Four Zoas was his own mythology of the 'dark gods' as well as his philosophy of the 'unconscious.'

Microfilm copy of complete manuscript of 349 pages, \$4.36. Enlargements 6" x 8", 10¢ per page.

#### AN INTRODUCTION TO SAINTE-BEUVE'S CRITICAL VOCABULARY

(Publication No. 3693)

Carl Albert Viggiani, Ph.D.  
Columbia University, 1951

This dissertation offers a systematic study of Sainte-Beuve's critical vocabulary. The initial period in Sainte-Beuve's criticism (1824-1830), during which his critical vocabulary took shape, sets the limits of the study, but continuity with both pre-romantic criticism and Sainte-Beuve's later works is provided. The dissertation is built around the key terms in his vocabulary, of which the most important are poète, élégiaque, style, and goût. The criteria for selecting terms to be treated were: first, the importance of the terms in the whole of Sainte-Beuve's writings, autobiographical and creative as well as critical; second, their inclusiveness, that is, how large a concept they represented and how great a portion of the entire vocabulary could be subsumed within them; third, a word count. The relation of minor terms both to each other and to the key terms is also studied.

The three parts of the dissertation correspond to the three groups of terms that center around poète, élégiaque, and style and goût. Occasional reference to other critics, both predecessors and

contemporaries of Sainte-Beuve, and to articles and works written by Sainte-Beuve after 1830, permits placing his use of certain terms in its historical setting, and also clarifies his meaning when contemporary dictionaries and his own criticism can give no help.

Part I is devoted to an examination of Sainte-Beuve's concept of the poet. This includes a consideration of a group of terms that are intimately related to poète: création, créateur, invention, génie, artiste, fécondité, fertilité, abondance, richesse, plénitude, force, énergie, vigueur, verve, facilité, originalité, nouveauté, fraîcheur. Sainte-Beuve's early idea of the poète primitif and its later elaboration in the Molière article (1830) are taken up, together with related terms (naïveté, franchise, naturel, simplicité, instinctif, faculté dramatique, sublime). The last chapter in Part I deals with Sainte-Beuve's notion of the social function of the poet, and concentrates on his meaning and use of the term consolation.

The key terms élégiaque, rêverie, and tendresse are the principal subject matter of Part II. They are the nuclei of two groups of terms in Sainte-Beuve's criticism: charme, enchantement, mystère, mélancolie, tristesse, plainte, loisir, recueillement, personnel, intime, symbole; and sensibilité, sentiment, pieux, onction, douceur, volupté, mollesse. A substantial portion of Part II is concerned with the organic relationship that binds his critical and poetic vocabularies, and with the transformation of aspects of his own poetic sensibility and aspirations into criteria of judgment.

Part III takes up two sets of terms, those associated with style (vérité, réalité, pittoresque, descriptif, couleur, coloré, couleur locale, couleur historique, métaphore, forme) and goût (atticisme, délicatesse, pudeur, décence, finesse, naturel, simplicité, harmonie, noblesse, élévation, gravité, austérité, correction, chasteté, pureté, élégance, grâce. With the first group of terms the study of what may be called Sainte-Beuve's romantic critical vocabulary, that is, the terms given new meanings and emphases during the first third of the nineteenth century, is terminated. It is shown that in the last group can be seen the foreshadowing of his subsequent break with romanticism and his slow evolution in the direction of a classical view of literature. The Conclusion points toward these developments in his criticism and suggests a study of them based on his later use of the key terms poète and goût.

Microfilm copy of complete manuscript of 308 pages, \$3.85. Enlargements 6" x 8", 10¢ per page.

#### CHARLES DIBDIN AND THE TABLE ENTERTAINMENT

(Publication No. 3924)

Edward Burdick Wisely, Ph.D.  
Columbia University, 1951

At his Sans Souci theatres, Dibdin was the real founder of the table entertainment, still persisting in



a more specialized, fragmentary style in the solo acts of the eccentric comedians of recent years. These modern performances, perpetuated in part through the phonograph, give frequent evidence of the persistence of the themes of Dibdin's songs and characterizations and of the hold of the solo-entertainer on his audience through the fascination of his gusto and personal charm. It was this fascination that enabled Dibdin's genius to accomplish an extraordinary feat, unique in the history of the stage: the operation for nearly twenty full seasons of a one-man show, written, performed, and accompanied by the artist himself, at his own theatre in a city of the size of eighteenth-century London.

The present work attempts to show how Dibdin brought this about. First, we see him at forty-three, led by circumstances and imagination to find his true *metier* and establish the tradition for a closely-linked chain of shows extending throughout the nineteenth century. Following this account, a detailed analysis of his entertainments and of the monologues and songs out of which they were constructed leads to a survey of subsequent outstanding solo-performers showing his influence in England and America.

Finally, records by many of these artists have been arranged to Dibdin's pattern at the San Souci, and the reader may hear, if he will, how the born table entertainer instantly united writer and composer, performer and audience. The development of the phonograph has made possible a new aural dimension of research in popular entertainment during a period extending almost half-way back to Dibdin. By using recordings extensively for the first time in such a study, the writer hopes to open up to further investigation a rich and strikingly vivid field of source material, hitherto all but ignored by the theatrical historian.

The Appendix gives an account of Dibdin's life before and after the period of the entertainments. The Bibliography contains Dibdin's works for the stage with dates of first production, a list of his non-dramatic writings, a selection of books and articles having reference to Dibdin, and a list of the uncatalogued Dibdiniana in the Harvard Theater Collection.

Microfilm copy of complete manuscript of 358 pages, \$4.48. Enlargements 6" x 8", 10¢ per page.

## MUSIC

### ANTON REICHA'S QUINTETS FOR FLUTE, OBOE, CLARINET, HORN AND BASSOON

(Publication No. 3697)

Millard Myron Laing, Ed.D.  
University of Michigan, 1952

Anton Reicha was born in Prague, Bohemia, in 1770, and died in Paris in 1836. Educated in Germany, in his youth he established himself as flutist

in the court orchestra of Bonn. The young Beethoven was a fellow-performer and intimate friend. Reicha eventually settled in Paris and became a French citizen. He served as Professor of Counterpoint and Fugue at the Conservatoire from 1818 to his death.

Reicha's large body of compositions includes twenty String Quartets, six String Quintets, many compositions for various small ensembles, Concertos, Symphonies, and Operas. His best-known works during his lifetime and in the century following his death were the twenty-four Quintets for wind instruments. Since they are among his most important works they apparently provide a valid basis for an evaluation of his acumen as a composer. Among the first works for the combination of flute, oboe, clarinet, horn and bassoon, the Quintets helped to establish Reicha as a leader in the musical life of Paris. No other composer has written so voluminously for this medium, yet today the Quintets and their composer are largely forgotten.

The first chapter of this study is devoted to Reicha's biography and his relationship to contemporaries. As supplementary material Reicha's *Autobiography*, in both its original French text and in a new English translation, is presented. Chapter II discusses the performers for whom the Quintets were composed and their instruments, and relates the Quintets to their classic antecedents. In Chapter III the Quintets are analyzed (1) as to type, form and interrelation of movements, (2) as to the style and treatment of thematic materials, and (3) as to characteristics of scoring. Four representative Quintets are analyzed in detail, with emphasis on individual aspects of form, thematic evolution, and relationship of tonalities. These works are presented in score in Volume II.

The results indicate that the Quintets are important in the history of wind chamber music (1) for their position in establishing the Wind Quintet as a medium of expression, (2) for their artistic merit, and (3) for their influence on later composers.

Reicha generously experimented with form and thematic treatment. He liked to develop a theme from a thematic germ previously heard, to relate different themes through the use of similar components, and to introduce basic themes in cyclic manner in successive movements of a composition. His unorthodox sequence of tonalities often anticipates later practices. Some of the Quintets continue in the classic style of Haydn and Mozart. Perhaps the most successful works are those resembling classic models. When Reicha uses unfamiliar materials, he sometimes falls into weaknesses of form and texture. From some of these weaknesses, however, his successors — among his pupils were Berlioz, Liszt, Gounod, and Franck — were to formulate important concepts of the romantic period of composition.

The Quintets reflect the excellence of wind-instrument playing in Paris in the early nineteenth century. Most of the works demand a high degree of technical proficiency, although certain movements may be performed by players of moderate skill. Selected Quintets such as those contained in Volume II are worthy of present-day performance. Altogether Reicha should

not be ignored in a study of the rise of romanticism in music.

Microfilm copy of complete manuscript of 622 pages, \$7.78. Enlargements 6" x 8", 10¢ per page.

#### THE MASSES OF ROBERT FAYRFAX

(Publication No. 3814)

Edwin Brady Warren, Ph.D.  
University of Michigan, 1952

The purpose of the present study is to gain an intimate insight into the musical style of Robert Fayrfax, one of England's most important but least known composers. Fayrfax, who lived from about 1465 to 1521, is one of the important links between Dunstable and the Tudor composers. His position as a leading British musician of his day has never been questioned, and in recent times he has been increasingly appreciated, but it is clear that full justice has not yet been done to him. A complete evaluation of Fayrfax's music cannot be made until all of it has been transcribed into modern notation and analyzed. This study is based on transcription and analysis of the Masses and constitutes the first step in making a complete evaluation of Fayrfax's music. The transcription of the five complete Masses appears in the second volume of this work.

Part I of Volume I projects the life and works of Fayrfax against the total background of musical activity in England in the late fifteenth and early sixteenth centuries. It also discusses the English treatment of the Ordinary of the Mass as preparation for the detailed analysis of the Masses of Fayrfax. Part II presents a detailed analysis of the music from the standpoint of form (*cantus firmus* and *motto* treatment), melody, rhythm, harmony, cadence practice, dissonance, texture, imitation, text-treatment, and notation.

The analysis reveals a style which is both reminiscent of the fifteenth century and prescient of the sixteenth. The archaic aspects are evident in the use of the *cantus firmus* and *motto* techniques, the traditional method of text-underlaying, the wide leaps, the longwindedness of some of the melodic lines, the syncopated rhythms, the almost exclusive use of major and minor triads in root position and first inversion, the extensive use of *fauxbourdon* and root movements by seconds and thirds, the frequent employment of the leading-tone, Burgundian, and "Ockeghem" cadences, and cadences in which the Bass leaps up an octave over the Tenor, the infrequent use of dissonance and nearly equal emphasis on the relatively-accented and primary types, the slow harmonic rhythm in the five-voice sections, the emphasis on three-part and equal-voice writing, the combining of disparate voice parts in proportional passages, and the occasional use of imitation in three of the Masses. Several progressive tendencies are apparent in the style: definite melodic contour and lyricism, repetition and sequence, complete triad structures, emphasis on

root movements by fourths or fifths with the emergence of the true Bass, 4-3 and other suspensions, five-voice writing, and considerable employment of imitation in two of the Masses.

The main conclusion to be drawn from this study is that the Masses of Fayrfax, in summarizing fifteenth-century English practices and helping to lay the foundation for the entire Tudor period, merit recognition as monuments of the English Renaissance.

Microfilm copy of complete manuscript of 643 pages, \$7.91. Enlargements 6" x 8", 10¢ per page.

#### SPEECH

##### AN EXPERIMENTAL STUDY OF CERTAIN RELATIONSHIPS BETWEEN INTELLIGIBILITY SCORES AND CLINICAL DATA OF PERSONS WITH DEFECTIVE ARTICULATION

(Publication No. 3748)

Victor Paul Garwood, Ph.D.  
University of Michigan, 1952

This study was concerned with the comparative evaluations of intelligibility by untrained listeners and expert examiners.

Speakers were first evaluated by experts who prepared a phonetic analysis and then rated the severity of the articulatory performance. Subject's utterances of words were then recorded on tape and played back in a prescribed order to untrained listeners. There were sixty-four male subjects, sixteen for each of four groups: Normal, Slovenly, Foreign Accent, and Dyslalic. Stimulus materials used in the experimental situation were C. V. Hudgin's four PBF (Phonetically Balanced, Familiar) word lists.

The findings were as follows:

1. Error tabulations and ratings of severity of articulatory defects by expert examiners were found to be significantly correlated.
2. Accuracy of word perception and intelligibility ratings by untrained listeners correlated significantly for the four types of speaker categories.
3. Tabulations of errors of the Foreign Accent group by experts and word perception by untrained listeners correlated significantly below the one per cent level. But relationships between both types of ratings and between ratings and tabulations for the Foreign Accent group were not significant.
4. Significant relationships between both types of clinical and experimental measurements for the Dyslalic group indicated that ratings were fairly valid as well as reliable.
5. From significant relationships between sound errors and rating procedures by expert examiners, it was assumed that the number of errors committed by speakers influenced examiners' judgments of the severity of the articulatory defect.
6. Significant analyses of variance for both word



perception and intelligibility rating showed that both methods of testing intelligibility successfully differentiated among the four groups of speakers.

7. Female listeners rated male speakers significantly higher than did male listeners, however there was no significant difference between the sexes in tabulations of errors in word perception.

8. Significant results from the analyses of variances of intelligibility scores among the four word lists indicated that they might not be equivalent. Whether one list, "C," was easier, or, whether by chance, the speakers uttering that word list were more intelligible, were presented as possible explanations of this finding. Ratings were relatively not significant.

9. That the significances of one Row and one Column variance indicated that the experimental design was only partially successful in controlling orders of presentation of speakers and lists. However this statistically uncontrolled factor of experience in listening did not seem to invalidate the significant discriminations.

10. Results obtained from a sample of listeners' evaluations of four speakers from each of the four categories showed that there was possibly a direct relationship between the number of sound errors and misperception of words in the experimental situation. There were indications that experts and untrained listeners tended to be most consistent when perceiving consonantal errors in the clinical groups—the Dyslalics and the Foreign Accent group.

Microfilm copy of complete manuscript of 113 pages, \$1.41. Enlargements 6" x 8", 10¢ per page.

#### THE COMPREHENSION OF POETRY FROM RECORDINGS

(Publication No. 3889)

Bernard Jon Goldstein, Ph.D.  
Columbia University, 1952

The aim of the study was to measure comprehension of poetry under various conditions of presentation. Responses of 200 college women to questions on the comprehension of poems were examined to determine A) whether poems were better understood when they were orally interpreted by 1) their authors or 2) by other readers skilled in the oral interpretation of literature and B) whether poems were better understood 1) when they were heard while respondents looked at the texts of the poems or 2) when they were heard in the absence of the texts of the poems. Other aspects of the problem were also considered. The relationship between the respondents' comprehension of the poems and A) certain social attitudes of the respondents; B) the age of the respondents; C) the professional interest choices of the respondents; and D) the readability indices of the poems.

The following principal procedures were carried out. A preliminary investigation was undertaken to

learn which recordings of poems read by their authors and included in the Contemporary Poets Series were most readily understood by the students. As a result of this investigation four recordings of poems read by their authors were chosen for use in the experiment. These were: The Fog by Robert P. Tristram Coffin; "Dover Beach" — a note to that poem by Archibald MacLeish; Law Like Love by W. H. Auden; and #33 by E. E. Cummings. These four poems were then transcribed on phonograph records by three readers believed to be skilled in the oral interpretation of literature. Their skill was validated by four expert critics of the oral interpretation of literature. A test, which permitted free responses by the students to questions on the comprehension of sense and feeling in the poems, was formulated and given to the experimental group. Forty-seven randomly selected responses to each poem were ranked by five judges with ability in literary criticism. Their rankings were correlated and the coefficients of correlation demonstrated that the sum of their judgments justified the construction of a rank order scale for each poem. However, it was found that the poem Law Like Love did not lend itself to the rank order technique used in the study and it was therefore discarded. The scales for each poem were constructed by translating the mean rankings of the five judges into scale values on a linear scale of ten points. The writer then ranked the 200 responses to each poem, assigning to it the scale value of the response it most closely approximated. The reliability of the writer's ranking was validated by three other individuals. In order to determine whether given social attitudes had an effect on the comprehension of the poems, four scales in the series The Measurement of Social Attitudes were selected because of their relationship to social phenomena embodied in the contents of the four test poems. The scales were administered to the experimental group.

Analysis of the data gathered in the course of the experiment disclosed the following findings. The comprehension of the poems in the experiment was not dependent upon the oral interpretations of the poems by their authors or by other individuals skilled in the oral interpretation of literature. The comprehension of the poems was greater when respondents listened to the poems while they looked at the texts of the poems than when respondents heard them in the absence of the texts of the poems. It was also found that the comprehension of the poems was dependent upon their difficulty, as determined by their readability indices.

Several implications may be drawn from the findings of the study. Teachers of poetry should receive training in effective oral interpretation of literature. Recordings of poetry should be subjected to critical analysis to determine their effectiveness in communicating the sense and feeling of the poems when they are used as materials for study and reference in English and Speech classes. Poetry should be presented to students orally, accompanied by the visual presentation of the texts of the poems. The findings of the study demonstrate that this method of presentation results in superior comprehension. Finally, study

should be made of students' ability to attend and listen to poetry with the view to increasing their comprehension of it.

Microfilm copy of complete manuscript of 111 pages, \$1.39. Enlargements 6" x 8", 10¢ per page.

**VARIABILITY OF THE ABSOLUTE  
AUDITORY THRESHOLD:  
A PSYCHOPHYSICAL STUDY**

(Publication No. 3764)

George Herman, Ph.D.  
University of Michigan, 1952

The purpose of this study is to explore the variability of the auditory threshold under experimental conditions, for comparison with the known variation in repeated clinical audiometric tests of the same subject. The literature on the reliability of audiometric measurements is surveyed.

An experiment is reported in which the absolute threshold for pure tones of 1000 cycles per second was studied. Nine normal ears were studied in one to five sittings each. Each sitting involved three types of series of tones. The intensity was increased in one decibel steps (ascending series), decreased in one decibel steps (descending series) and varied randomly over a range of ten decibels. The subject was required to signal whether he heard each tone.

The proportion of "yes" responses at each intensity level did not differ significantly between ascending and descending series; for some sittings of some subjects, the random series showed significant differences from the other two. The difference was not systematic, and was considered to be the effect of fatigue, since this series always came last in the sitting.

Psychometric functions were constructed by fitting the phi-gamma function to the data, using the mathematical process developed by Muller and Urban. Functions were computed for each sitting of each subject and for all sittings of each subject. No significant differences were observed among the sittings of any one subject. A psychometric function was computed which represents the total subject group. This function is the cumulation of a normal distribution with a standard deviation of 6.72 db.

From this function a theoretical prediction of average results of the type of series used in clinical audiometry is derived. The standard deviation of this distribution is 5.57 db for either ascending or descending audiometric series; the mean for the latter is somewhat higher than for the former. The dispersion of audiometric tests of the same subject as reported in the literature is in reasonable agreement with the theoretical prediction, if allowance is made for the use of several series at each frequency in a clinical test.

It can be concluded from this study that the fitting of the phi-gamma function is a satisfactory procedure for the study of the psychometric function for absolute auditory thresholds. This function (for a single subject) does not vary significantly over a period of several weeks.

It appears that the variation in clinical audiometric tests of the same subject is attributable to the variability of the subject's sensory behavior, rather than to the nature of the clinical test. The variability which has been observed over periods of several months is demonstrable during much shorter periods.

Microfilm copy of complete manuscript of 173 pages, \$2.16. Enlargements 6" x 8", 10¢ per page.

**RHETORICAL PROOF IN SPEECHES OF WOMEN  
OF THE REFORM PLATFORM: 1828-1861**

(Publication No. 3909)

Lillian Mary Frances O'Connor, Ph.D.  
Columbia University, 1952

The purpose of this study was to collect and analyze the texts of speeches to discover the uses, if any, of the three types of rhetorical proof: ethos, pathos, and logos. The first address given by a woman before an audience of men and women was that of Frances Wright delivered on July 4, 1828, at New Harmony, Indiana. The years between that date and the opening days of the Civil War in 1861 constitute the first period in history in which women made a concerted effort to address their ideas to audiences of men and women. They spoke in favor of reforms so that practice might approximate more closely the ideals of democracy. The story of their struggle for recognition as public speakers is the historical background of this study.

A search for data resulted in the discovery of one hundred and forty-five extant texts by twenty-seven women. The topics were free inquiry, better opportunity for free Negroes, abolition of slavery, temperance, and woman's rights. Two of the speakers were foreigners, one British and one Polish; of the native-born individuals three were Negro and twenty-two were white. Some were independently wealthy; one had been a slave in her youth.

In order to have a basis for the evaluation of the rhetoric of the women who spoke on the reform platform, the rhetorical theory of Aristotle and of the mid-nineteenth century rhetorical writers was analyzed, in relation to ethos, pathos, and logos. The Aristotelian ideal required high moral character, intelligence, and good-will of the speaker (ethos), an appeal to the emotions of the audience (pathos), and logical argument based upon the facts in the case (logos). The mid-nineteenth century ideal also required that the speaker be of high moral character and a person of intelligence. Moreover, the appeal to the emotions should be of a pathetic nature, and should be presented in a separate section of the speech. Logical argument should precede the emotional section.



Hugh Blair, the most popular writer of the day, maintained that meditation upon the facts of the case was the only help rhetoric could offer the speaker with regard to logos.

The analysis of the texts brought to light evidences of all three types of rhetorical proof. In those of earliest date, the emphasis lay in ethical proof and in proving that the speakers were women of high moral character doing God's work. In 1848, emphasis was shifted to maintaining that woman was possessed of intelligence. The greatest number of speakers was not concerned with the third element of ethical proof, namely, good-will toward the audience.

Pathetic proof is presented by the women speakers in the form recommended by the writers of the mid-nineteenth century, viz., as a separate section of the speech. The widespread use of this kind of division makes it probable that the speakers were familiar with the standards of the day and were attempting to exemplify the conviction-persuasion duality currently in vogue. Only two speakers, Frances Wright and Lucy Stone, appeared aware of the need of adaptation to the audience.

Much of the materials used in the logical arguments was drawn from the accepted sphere of woman: the Home and the Church. In addition, some arguments were drawn from knowledge of history, finance, government, legislation, medicine, sociology, and the arts. Deductive reasoning predominated in the speeches on abolition and temperance, and in those delivered by Frances Maria W. Stewart. Texts on other topics were developed inductively, in large measure. Rhetorical devices, such as reductio ad absurdum, Turning the Tables, and the Dilemma, were used. The logical argument is almost wholly grounded upon assumptions of a moral or humanitarian nature; in only a few texts is the premise one of expediency.

Microfilm copy of complete manuscript of 305 pages, \$3.81. Enlargements 6" x 8", 10¢ per page.

**A CRITICAL STUDY OF  
BOOKER T. WASHINGTON AS A  
SPEECH-MAKER WITH AN ANALYSIS OF  
SEVEN SELECTED SPEECHES**

(Publication No. 3790)

Willis Norman Pitts, Jr., Ph.D.  
University of Michigan, 1952

This is a study of the speechmaking of Booker T. Washington, outstanding American Negro educator. Its purpose is to gain understanding of the speaker's public address by (1) giving some attention to the political, economic and social forces which left their impact upon the era and upon the man, by (2) making an analysis of the speaker's philosophy, and by (3) making an analysis of a number of his speeches.

For this purpose, the study is divided into three parts. Part I deals with an examination of the facts,

both biographical and historical, which apparently left their imprint upon the man and upon his speech-making. Part II first develops the philosophy of the speaker along political, economic and social lines, and then traces the speaker's philosophy through a number of his speeches. Using the traditional concepts of Invention, Arrangement, Style and Delivery, Part III applies the rule of rhetorical judgment to seven public addresses of this speaker.

The results of the study indicate that:

1. From boyhood and school experiences, Booker T. Washington developed his attitude toward a policy and plan of education for his race.
2. Because of his ability to harmonize his aspiration and plan with dominant aspirations and plans of his era, Washington gained prominence as an educator and a speechmaker.
3. His speeches reveal a chief concern with the issues of cooperation and good will between white and colored races in the South, of education of the colored people of the nation, and of the mutual responsibility of all groups for the nation's welfare.
4. His philosophy points to an advocacy of conciliatory rather than aggressive tactics in race relations, to his position as a strong exponent of industrial education for his race, to his emphasis of land, home and business ownership and his deemphasis of political ambitions among his own people.
5. Numbering in the thousands, his speeches show evidence of having been delivered before varied racial groups in all sections of the country and before audiences of many types, including students, teachers, farmers, business and professional groups, and church organizations.
6. Persuasion and instruction appear to be chief ends of his speeches which are mainly logical in nature. His speech arrangement is characterized by the use of inductive method. Strongly implemented with statistics, analogy, example and story, the speeches can be generally said to discuss questions of policy through the use of problem solving techniques.
7. Evidence of good emotional argument in Washington's speeches is seen in his appeals to the sense of moral obligation, to own property, to build good reputations, and also in his plea for conciliation.
8. Washington's speech composition contains a large number of loose, complex, and simple sentences which are often marked by uncoordinated phrases and by digression.
9. Of medium height and possessing a direct straight-forward manner, the speaker apparently combined tact and humor with modest conversational speech.
10. A general conclusion is that speechmaking played a prominent role in the popularity of Washington as an outstanding figure in an era of American history.

Microfilm copy of complete manuscript of 314 pages, \$3.93. Enlargements 6" x 8", 10¢ per page.

# BROADCASTING BY THE NEWSPAPER-OWNED STATIONS IN DETROIT, 1920-1927

(Publication No. 3819)

Maryland Waller Wilson, Ph.D.  
University of Michigan, 1952

Radio Station WWJ, owned and operated by The Detroit News, claims distinction as the first station in America to broadcast regularly scheduled programs. It was the first newspaper-owned station as well; and, as such, it is worthy of study. Radio Station WCX, owned and operated by The Detroit Free Press, was the second and only other newspaper-owned station in Detroit. The circumstances under which it operated were far different from those surrounding WWJ; and the contributions of this second station were distinctly its own. For these reasons, and for the sake of comparison, this station also is worthy of study.

Little in the way of previous research has been done in this field. Material contained herein has been compiled from the newspapers of the period and supplemented by interviews with the remaining pioneers of the two stations. Primary sources have been quoted extensively in an attempt to give an accurate picture of the broadcasting situation in Detroit between 1920 and 1927 and an added insight into the background of that era.

The writer has attempted to remain objective in presenting this study, the main purpose of which has been to learn the form and content of the broadcasts themselves. Technical information has been included only incidentally. Chapters have been arranged chronologically by year and by station, with the final chapter summarizing the activities of each.

WWJ early realized its responsibility as a public service medium. In 1922 it created what has often been called the first orchestra in the world organized for the purpose of radio broadcasting. In the same year it introduced its Town Crier, its daily household programs, its talks on music appreciation, its physical exercise programs, and others whose style has not changed appreciably through the years.

WCX developed the star system, the informal program, and the "give-away" programs. It pioneered in the early adaptation of drama for the air as well as the broadcasting of actual stage productions. It pointed the way which many stations were to follow in their presentation of the comics, and it demonstrated effectively the influence of radio as a social force and as an instrument of mass persuasion.

The reader is left to judge for himself whether radio has progressed to any marked degree since 1927. He has seen (1) the coverage of entertainment, sports, and national events become a regular feature of broadcasting; (2) the lure of the "ether" come to rival that formerly held by the stage alone; (3) program ideas which today are considered new experimented with in the "good old days"; (4) the effects of commercialism on one station which struggled to hold high its standards, on another which wore itself almost to exhaustion in attempting to meet the popular demands; and both stations swayed by their surging tide; and (5) the end of the pre-commercial era and the beginning of commercialism.

Microfilm copy of complete manuscript of 300 pages, \$3.75. Enlargements 6" x 8", 10¢ per page.

## PHILOSOPHY

### A PRAGMATIC STUDY OF LANGUAGE AND VALUATION

(Publication No. 3727)

Broadus Nathaniel Butler, Ph.D.  
University of Michigan, 1952

The specific problem of this study is to discover an adequate approach to the clarification of the interpretation of the language of value discourse. The study is an endeavor in theory of valuation from an orientation in which the use of language is projected as the primary focus of interpretation. The perspective is empirical and practical since the study is directed to the intelligent interpretation of the concrete conditions of valuational utterance. The

general problem is to interpret and, as far as possible, to synthesize the contributions of diverse philosophical viewpoints on theory of value in a comprehensive pattern of clarifications of the meanings and functions of ordinary value symbols.

The method by which this task is approached consists of two phases. First, we endeavor to secure an understanding of the problems involved in the communication of meaning by use of language in general and philosophical language in particular. In anticipation of the second phase of the study, the traditional interpretation of linguistic utterances is sacrificed in order that the comprehensive endeavor will not be bound by the limitations of conventional linguistic classifications and rules. In the second phase we make a four-part classification of value



utterances which permits the broadest possible discussion of value language references. Under the headings of immediate value, relational value, moral value, and comparative value, the problems of value meaning are isolated and related to the problems of ordinary language usage to elucidate the characteristics which are peculiar to the comprehension of the mode of language usage which is called valuation.

The study does not represent a final and conclusive argument for one or another theory. It projects the hypothesis that value language is primarily a functional language which is highly suggestive, but intrinsically imprecise. The thesis is that the interpretation of the language does not follow the general rules of logical analysis, and the evaluative process cannot be reduced to a strictly formal system. Nevertheless, it does not follow from the general imprecision of value references that value utterances do not have precise meanings in particular contexts and modes of imputation. Value language is unique in that it does not share the properties of a completely formal syntax, yet it falls within the purview of consistent discourse and clear comprehension. The comprehensive interpretation of value language suggests uniformity, but the only kind of uniformity which truly characterizes this language is that kind which derives solely from the nature of direct satisfaction as a basis for envisioned possibilities of indirect satisfaction.

While a general conclusion could only be suggested and not argued with finality, specific decisions about each of four major classifications of valuational utterances are indicated. The general conclusion which we suggest is that each mode of value imputation represents a distinct aspect of one meaning which we term satisfactory experience, and the modes of such satisfaction must be interpreted in terms of contexts and conditions. For purposes of theory, satisfactoriness must be interpreted as being contingent upon psychological and sociological conditions which are subject to the plasticity of human experience. Therefore, precision in value meaning is conceivable as an unattainable ideal or a model for successive approximations to perfect experience; and an adequate approach to comprehensive valuation is, then, similar to a series of probability judgments which presupposes an order of satisfactions in life.

Microfilm copy of complete manuscript of 305 pages, \$3.81. Enlargements 6" x 8", 10¢ per page.

## DIALECTICAL METHOD

(Publication No. 3685)

Choon Sup Kim, Ph.D.  
Columbia University, 1952

### Part I. HEGEL'S DIALECTICAL METHOD

Generally speaking, Hegel's method is idealistic because his dialectic is a spiritual dialectic. According to him, thought is dialectical, and as understanding, it must fall into contradiction and he insists that this contradiction is resolved by the reason. Hegel does not think that matter is independent of the spirit. I cannot agree with him about this point because we cannot think without the being which is thinking, that is, the body. Matter is not a kind of spirit but is absolutely independent from the spirit. Hegel did not recognize this character of the independence of matter from spirit. Therefore his is not a true dialectic because it does not involve an absolute contradiction. For Hegel the contradiction always was a spiritual contradiction. He did not recognize the contradiction outside the mind. Therefore his method was an idealistic and a one-sided method of mind.

### Part II. MARXIST DIALECTICAL METHOD

As Marx says, the Marxist dialectical method is a method which stands Hegel's dialectical method on the head. The Marxist dialectical method is materialistic and insists that the world reveals contradiction, therefore the mind which is a part of the world also has contradiction. Marxists do not recognize the different character of the mind from the matter. The Marxist method can explain the contradiction of the outside world, but it cannot explain the contradiction of the inside world because they think that the dialectic concept is the reflection of the dialectic of the world. But I cannot agree with this point because mind is not matter. Matter cannot have the creative power of science, ethics, art, religion and philosophy. Mind has its own character and though it is based on matter it is not itself matter, therefore the materialistic Marxist dialectical method is not enough to explain the contradiction of mind. It is also a one-sided method of matter opposite to Hegel's dialectical method.

### Part III. A TRUE DIALECTICAL METHOD

As we see above, Hegel's dialectical method and the Marxist dialectical method are both one-sided methods, the one spiritualistic, the other materialistic; therefore, a true dialectical method must be a method which combines both, nay develops dialectically from both. The world including the human being involves the materialistic and spiritualistic contradiction; therefore, in order to explain it we must use at least the materialistic-spiritualistic dialectical method, that is, a true dialectical method. The contradiction of mind is different from the contradiction of matter and vice versa. True contradiction exists between mind and matter, and as they con-

tradict absolutely, they can have dialectical development, because contradiction is identical to itself as the contradiction in understanding is not contradiction when we think of it from the standpoint of reason. Therefore, if we want to use the dialectical method, we need to use a true dialectical method which is not inclined to one side, and includes both sides, spirit and matter. But the dialectical method is not the sole method of studying human culture and nature.

#### Part IV. SYSTEMATIC METHOD

I explained my standpoint in criticizing the dialectical method. The dialectical method presupposes that the whole world has contradictions and that it is advancing by these contradictions. But this presupposition cannot be supported because we can find that the world also has a harmony and identity, and the world sometimes advances by this harmony and love. Furthermore, moving presupposes something fixed. Without stability, there can be no motion and vice versa, but the dialectical method disregards this unmoving phase behind the moving. Behind history we cannot but recognize the eternity which is always present. The dialectical method is not the only method but is a species of method among many methods. We have many methods and each has its own meaning; therefore we must unify and systematize all the methods and according to object, subject, time, space and condition we must choose the suitable method appropriately. If we always use one method dogmatically, or if we are mistaken in using a suitable method, we cannot understand the object truly. Moreover, when we study the object, sometimes we find a suitable method for the object, and sometimes we have to change our method according to the requirements of the case. Therefore, to insist that we should always have one method or to have a method preceding the object are both dogmatic positions. Systematic method insists upon the unification, organization and systematization of all kinds of methods including the dialectical method, and it tries to find the best method to apply by studying the object. It also insists upon the cooperation of all methods from the higher dynamical viewpoint for studying the world culture and philosophy as a whole, in order to establish a healthy view of life, a scientific view of the world, and a philosophical view of the universe.

Microfilm copy of complete manuscript of 291 pages, \$3.64. Enlargements 6" x 8", 10¢ per page

#### DEONTOLOGY AND THE MORAL LIFE: THE ETHICAL WRITINGS OF H. A. PRICHARD, W. D. ROSS, E. F. CARRITT, AND C. D. BROAD

(Publication No. 3902)

Melvin Lubin, Ph.D.  
Columbia University, 1952

Deontology or the science of duty is expounded most clearly by Prichard, Carritt, Broad, and Ross.

(A) From the truism that most obligations (social responsibilities) do not originate with logical arguments, the deontologists argue that therefore the moral "ought" cannot mean the same as "productive of good." This argument depends on a descriptive phenomenological theory of meaning, which when coupled with the fact that an experience of bindingness accompanies most obligations, leads to the contention that their meaning is ineffable. This stifles all inquiry at the outset. More fruitful would be an explanatory theory of meaning leading to an analysis of obligations in terms of social relations and their efficacy. That is, moral "ought" may or may not mean the same as "productive of good."

(B) Intuitionism is an unnecessary encumbrance to deontology and impedes understanding of the social conditions for the occurrence of obligations. It further fails to account for mistaking, changing and differing over, obligations. Actually intuitions are only relatively immediate, representing pasts replete with verifications and their opposites. This is implicitly admitted by the deontologists analysis of (I) intellectual emotion, (II) the genesis of intuitions, and (III) objective and subjective right and wrong, all of which imply mediation of intuitions by past cognitions.

(C) The deontological solution for cases of conflicts of obligations substantiates our criticism that they contradictorally consider mediate (evaluative) as well as immediate (intuitive) elements. An examination of the notions of (I) prima-facie-ness, (II) tendency, and (III) toti-resultants, and of the criteria of (x) triviality, (y) stringency and (z) gravity, reveals that solutions of conflicts are in terms of goods or values involved, and not in terms of duties. No reason is given why intuitions do not function in these complex as well as simple situations.

(D) Moral goodness is wrongly separated by the deontologists from ethical goodness. The former it is said, proceed from good motives which not being voluntary, cannot be obligatory. Neither can we be responsible for the effects of our actions. Thus it is maintained that it can only be our duty to set ourselves to do what we think we ought to do in a situation as we take it to be. The criterion makes impossible the judgment of any moral agent by this action which reveals neither his motives nor his duty. Nor is this criterion vindicated by the usual deontological criterion of common sense, which holds not that it is our duty to set ourselves, but that it is our duty to do.

(E) (I) Carritt holds choice to be absolutely spontaneous, not depending on political or social conditions, thus maintaining an interest theory of freedom though he opposes an interest theory of duty. This can lead to *laissez faire* philosophy and the opposite



of freedom. (II) For Broad freedom depends on whether mental substances have causes. This overlooks the fact that all events are caused, and that logically, competent examination would lead to an infinite regress. Ross, while purporting like Broad to give a genetic analysis of "Will" actually describes the conditions under which an intelligent person makes decisions. This analysis could suggest positive methods by which freedom may be extended, for Ross properly sees mind as will in the process of actualizing itself. However, even this most adequate of deontological analyses fails to understand the function of objects including institutions, as tools for the attainment of freedom. The individual cannot be the sole source and criterion of freedom. This lack typifies this phenomenological, anti-Hegelian, deontological revolt. It raises as many difficulties as it solves, removing many problems from the contexts in which alone they can be solved.

Microfilm copy of complete manuscript of 176 pages, \$2.20. Enlargements 6" x 8", 10¢ per page.

#### RALPH CUDWORTH'S PHILOSOPHICAL SYSTEM

(Publication No. 3688)

Marilyn Meyer, Ph.D.  
Columbia University, 1952

The purpose of this study is to give a clear account of Ralph Cudworth's philosophical "system" and to present for the first time a statement of his ethical theory which is an essential part of it. This statement is based on materials not used in any previous studies of Cudworth, primarily his treatise *On Free-Will*. A detailed summary of the contents of this treatise is given in the Appendix.

Ralph Cudworth is considered the leading member of the 17th century group of thinkers in England known as the Cambridge Platonists and identified by its interest in Platonic writings and its opposition to Calvinist dogma. Cudworth is noted also for directing the first polemic against the philosophy of Thomas Hobbes.

Against Hobbes' materialism, sensationalism, and determinism, Cudworth pitted carefully worked out forms of idealism, rationalism, and an interesting theory of free-will.

Cudworth's idealism is the subject of his best-known work, *The True Intellectual System of the Universe*. Here he argues that the world cannot be explained merely in terms of matter and local motion but must be due to mind... or a self-active, purposeful principle since matter cannot organize or direct itself. Cudworth adopts Plotinus' Nature or "vegetative world-soul" as an agent of Mind (or God) in the world and combines it with Cartesian mechanism. This doctrine of "plastic nature," as he calls it, influenced British thinkers from Berkeley to Coleridge and Wordsworth.

In the second part of his system, the posthumous *Eternal and Immutable Morality*, Cudworth argues that knowing is not merely the outcome of sense-impressions; sense cannot get beyond itself to form judgments. Knowledge is due to an "active power" of the mind itself which organizes sense-experience according to its own categories. In his insistence on the categories of the mind and in his efforts to clarify the nature of knowing according to them, Cudworth has become identified as a forerunner of Kant.

However, Cudworth does not develop the implications of his doctrine of knowledge as *a priori*. This is due at least partly to the fact that his ultimate concern is not epistemology but ethics. Commonly, however, his moral theory has been called "intellectualistic" since historians have deduced it from his theory of knowledge and have not made use of his unpublished ethical treatise *On Free-Will*.

The treatise *On Free-Will* places Cudworth's ethics into a new perspective. Here he insists that the intellect cannot be a moral agent: it may know the good but it cannot will it. However, he does not posit a faculty of "will." For Cudworth, it is "the whole soul or man" which wills.

The willing power of the soul is based on its self-activity. The soul is not only capable of acting upon external objects, as in knowing, but it is also able to act upon itself and thus direct itself. This Cudworth calls the "reduplicated" self-activity of soul. The soul is able to choose among its various "components" or motives, e.g., between its selfish instincts and its love of the good.

Thus, free-will does not mean indeterminism but self-determination. The soul is free to choose a higher or lower good; when it chooses the latter, it is abusing its capacities.

The apex of Cudworth's system is his theory of free-will. Negatively, he has prepared for it by showing that neither the world nor the individual is mechanically determined from without; positively, his epistemology has led to the "demonstration" of the self-activity of the soul on which its free-will depends.

Microfilm copy of complete manuscript of 322 pages, \$4.03. Enlargements 6" x 8", 10¢ per page.

## PHYSICAL SCIENCES

### ASTRONOMY

#### THE EXCITATION OF THE NETWORK NEBULAE IN CYGNUS

(Publication No. 3731)

Joseph Wyan Chamberlain, Ph.D.  
University of Michigan, 1952

The Network nebulae, for which no exciting star has yet been found, are studied with the objective of determining their mechanism of excitation. Two competing theories, that of excitation by stellar radiation and that of collisional excitation, are used to interpret the intensities of the nebular spectral lines, in an effort to find which theory gives the more consistent picture.

The observations consisted of direct photographs made with a 24-inch,  $f/3.5$  Schmidt telescope, utilizing various combinations of filters and emulsion types to isolate different emission lines of oxygen and hydrogen. Photometric comparisons were made with a suitable standard; the surface brightnesses were thus obtained for several filaments in the nebulae. Since approximate information on the sizes of the radiating volumes is available, the filamentary emission in  $\text{ergs/cm}^2\text{-sec}$  has been estimated.

Theoretical calculations on collisional excitation of hydrogen in a nebula are presented. The Balmer decrement is computed for several temperatures and the results are compared with those obtained by Menzel and Baker for the case of stellar excitation of nebulae. Collisional cross sections based on Born's approximation are used in the computations. A method is presented for computing the Balmer decrement when radiation and collisions are both important and when the electron density and temperature of the nebula and the ultraviolet temperature and dilution factor of the stellar radiation are assumed. A numerical example is presented, showing the effect a particular star would have on the Balmer decrement at various distances from a nebula.

The observational data as interpreted by the collisional theory seem to give the most consistent picture at  $T_e \sim 20,000^\circ\text{K}$ . Although the O/H ratio appears to be too small by a factor of 5.5, reasons are given for suspecting a considerable portion of the oxygen to be in ionization stages not observed. Very nearly the same picture is given by radiation-excitation theory (Menzel and Baker's case  $A_2$ ) at  $10,000^\circ\text{K}$ . However, since the indications are that the temperature is considerably above  $10,000^\circ\text{K}$ , the collisional theory is to be preferred. A need for further observations is emphasized: Measurements of the Balmer decrement would be especially valuable.

Inasmuch as the excitation mechanism may be intimately related to the filamentary structure of

the nebulae, some of the problems of structure are discussed briefly. The fluctuations in brightness in three different regions of the nebulae are treated from the standpoint of turbulence analysis. These fluctuations seem to be qualitatively the same in all three regions, even though the appearances of the regions on a photograph are quite different. J. M. Burgers' attempts at explaining the structure by hydrodynamical treatments are discussed and a statement of the present status of this aspect of the problem is given.

Microfilm copy of complete manuscript of 82 pages, \$1.03. Enlargements 6" x 8", 10¢ per page.

#### HYDROGEN ABSORPTION LINES IN THE SPECTRA OF B-TYPE STARS

(Publication No. 3784)

Jean Knox McDonald, Ph.D.  
University of Michigan, 1952

This investigation is an attempt to use the characteristic difference in the shapes and intensities of the hydrogen lines in the spectra of B-type stars as a criterion of the distances of the stars, by predicting theoretically from model-atmosphere computations, the profiles of the hydrogen lines as a function of surface gravity and temperature, and then relating these results to the observed profiles in the spectra of B-type stars of known distance (or absolute magnitude).

Spectra of ten carefully selected stars in the range BO-A2 were secured with the 73-inch reflecting telescope of the Dominion Astrophysical Observatory, Victoria. These spectra covered the region of the Balmer lines and as much of the Paschen region as possible. The residual line intensities and equivalent widths for the Balmer lines,  $H\alpha$ ,  $H\beta$ ,  $H\gamma$ , and  $H\delta$ , are presented for the spectrum of each star in tabular form, and a graphical comparison is shown of the shapes and intensities of the lines for varying temperatures and absolute magnitudes.

The theory of model stellar atmospheres is discussed, and following the method devised by Ström-gren, a model is computed for an assumed effective temperature,  $20,700^\circ\text{K}$ ; assumed gravity,  $\log g = 3.80$ ; and assumed abundances of the elements by weight, hydrogen:helium:heavier elements = 1000:800:50. The condition of radiative equilibrium is shown to be well satisfied for the model. The computed flux is constant within  $\pm 4\%$ , for optical depths from 0.00 to 2.00, and this constancy of flux is found to be relatively insensitive to alterations in the assumed grey-body temperature distribution. The energy distribution in the continuous spectrum of the model is



compared with that of a black body, and the Balmer discontinuity, the bolometric correction and the colour temperature (Greenwich scale) are computed for the model. These values are, respectively, 0.105, -2.63, and 35,000° K. The value of Balmer discontinuity and the computed number of observable hydrogen lines, when compared with observations, support the assumption that the model approximates a main-sequence B2 star. The profile of the H $\gamma$  line is computed for the model, assuming two different re-emission processes to be operating, monochromatic radiative equilibrium (pure scattering) and local thermodynamic equilibrium (pure absorption). The computed profiles are compared with the observed profiles of H $\gamma$  in the spectra of four stars in the range B1-B3, Morgan classification III or IV. It appears that the contour of the wings of the lines, computed by either of the assumed processes, represents rather well the observed profile for a star of type B2.5 IV, but neither process yields a good representation of the line centre. Suggestions are given for expecting discrepancies to occur between observed and theoretical profiles at the line centre.

The conclusion, based on the present investigation, is that the currently used model-atmosphere method of computing the H $\gamma$  line profile will not provide a sufficiently discriminating criterion of the absolute magnitudes of the B-type stars, but an extension of the investigation to additional models, to be undertaken in the immediate future, may possibly modify this conclusion. The observational material is considered to be reliable and accurate, and is so presented that it may be used in an extension of this investigation, or in other related studies.

Microfilm copy of complete manuscript of 113 pages, \$1.41. Enlargements 6" x 8", 10¢ per page.

## CERAMICS

### DETERMINATION OF PROGRESSIVE CORROSION OF CLAY FLUX BLOCKS

(Publication No. 3847)

Ved Prakash Maheshwary, Ph.D.  
University of Missouri, 1952

During the last two or three decades extensive studies have been made by the research workers in the United States, United Kingdom, Germany and other countries with a view to developing a suitable and reliable method for the determination of attack on refractories by molten slags and glasses. An up-to-date review of significant literature available on the subject has been presented, and it affords sufficient testimony to the extensive work done by the technologists on the problem. However, it has not been so far possible to adopt a single test as a standard to evaluate the corrosion of a refractory by a known corrosive liquid. The idea of measure-

ment of progressive corrosion of a refractory has been still more difficult to work out than that of corrosion of the refractory after a certain time period.

An attempt has been made in this investigation to make use of the progressive change in a physical property of the molten liquid in contact with the refractory as a measure of its progressive corrosion by the liquid. Viscosity has been the property which has been successfully used for such a study. The Torsional Oscillation Method for viscosity determinations with a Concentric Cylinder Viscosimeter has been employed, and the results thus obtained have been compared with data from the Hot Load Test and Cavity Test made upon the flux blocks used in this investigation. The information obtained from the three tests has been supplemented with the observations made on the physical and mineralogical structure of the flux blocks, which were mainly obtained by the use of Faxfilm replica technique, and petrographic as well as X-ray studies respectively.

While the results obtained from the Cavity Test and the Viscosimeter are in conformity with each other, it is realized and concluded that the information obtained from the Hot Load Test is not of a reliable nature as regards the resistance to corrosion of a Clay Flux Block against a glass, for the Hot Load Test takes into account only the physico-chemical properties of a refractory and neglects those of the molten corrosive liquid.

It is also concluded that the physical properties of a clay flux block at the temperature to which it is to be exposed are of greater significance in the estimation of its corrosion resistance against a molten glass than those determined on the block as received.

Possibilities of adaptation of electrochemical means to the problem have also been explored. These efforts, however, have not been promising due to apparently inexplicable observations encountered in this phase of the investigation.

Limitations in the interpretation of progressive viscosity determinations as a measure of progressive corrosion of a refractory tablet kept submerged with a platinum weight at the bottom of a platinum-rhodium cylindrical crucible containing molten glass at a constant temperature are mentioned and appraised.

Microfilm copy of complete manuscript of 218 pages, \$2.73. Enlargements 6" x 8", 10¢ per page.

## CHEMISTRY

### REDUCTION BY GALLIUM, ALUMINUM AND MERCURY IN AQUEOUS SOLUTION

(Publication No. 3927)

Charles Robert Allenbach, Ph.D.  
University of Buffalo, 1952

When gallium is used as a reducing agent in aqueous solution it is converted to the gallic ion, Ga<sup>+++</sup>.

The colorless gallic ion was never found to interfere in any way with the other products of the reduction or their subsequent oxidation.

A study of the corrosion of gallium in various acid solutions has shown that, in general, it is not readily attacked by hydrochloric, sulfuric or phosphoric acids. Hydrochloric acid was found to be much more corrosive than sulfuric or phosphoric acids.

It was found that iron (III) can be quantitatively reduced to iron (II) by gallium in hydrochloric acid, sulfuric acid or hydrochloric-sulfuric acid mixtures. Shaking the solution, which causes the globule of liquid gallium to become separated into many smaller ones, increases the rate of the reduction. Reduction of the iron (III), as well as the other oxidants studied, was found to be more rapid in hydrochloric acid solutions than in sulfuric acid solutions. Heating the solutions always increased the rate of the reduction process considerably.

The very unique behavior of gallium in forming a suspension of fine particles of the metal when shaken in sulfuric acid solutions at temperatures slightly below its freezing point was discovered and it was observed that reduction proceeds very rapidly in these solutions because of the greatly increased surface area of the gallium in the reaction mixture.

The reducing action of gallium has also been observed in studies which have shown that small amounts of hydrogen peroxide are produced when gallium is present in acid solutions exposed to the air or oxygen.

It has been found that gallium reduces uranium (VI) to uranium (IV); no further reduction to uranium (III) was ever noted.

The reaction between gallium and titanium (IV) has been investigated and quantitative reduction to titanium (III) has been achieved.

The reduction of copper (II) to metallic copper by gallium has been effected. It was found that the small grains of metallic copper produced could be separated from the gallium with ease and that the gallium suffered no harm from its association with the metallic copper.

The reduction of molybdenum (VI) to molybdenum (V) has been found to occur in dilute acid solutions. In stronger acid solutions, further reduction to molybdenum (III) has been observed.

Gallium readily reduces vanadium (V) to vanadium (IV) and then, more slowly, it reduces the vanadium (IV) to vanadium (III).

The earlier work of Schwartz (1) on the use of aluminum powder as a practical reducing agent has been extended to cover the reduction of uranium (VI) and titanium (IV). Uranium (VI) is reduced to uranium (IV) with a small amount of uranium (III) also being formed when the reductions are performed in a hydrochloric acid solution. No formation of uranium (III) was noted when sulfuric acid solutions were employed. The reduction of titanium (IV) by aluminum powder has been investigated and quantitative reduction to titanium (III) has been achieved.

The determination of the reduced titanium (III) with ceric sulfate, using o-phenanthroline ferrous

complex as indicator, has been studied and its use is highly recommended.

The use of a mercury reductor for the determination of copper (II) by reduction to copper (I) has been investigated. Copper (II) is quickly and completely reduced to copper (I) by mercury in hydrochloric acid solution. The copper (I) is very susceptible to air oxidation and quantitative results can only be obtained in the complete absence of air.

Contrary to the conclusions of McCay and Anderson (2) who stated that titanium (IV) was not reduced in the mercury reductor, the reduction of titanium (IV) has been found to occur when hydrochloric acid solutions greater than four molar are employed. Investigation has shown that titanium (IV) is rapidly and quantitatively reduced to titanium (III) by the mercury reductor when strong acid solutions are used.

1. Schwartz, Ph.D. Thesis, The University of Buffalo, June 1951.

2. McCay and Anderson, J. Am. Chem. Soc., **43**, 2372 (1921).

Microfilm copy of complete manuscript of 99 pages, \$1.24. Enlargements 6" x 8", 10¢ per page.

### MECHANISM OF RUBBER REINFORCEMENT III VISCOSITY OF CARBON BLACK SUSPENSIONS IN GR-S SOLUTIONS

(Publication No. 3663)

Leonard Edward Amborski, Ph.D.  
University of Buffalo, 1952

It has been shown that the Young's modulus of elasticity of an elastomer is increased by the addition of filler particles according to the following equation:

$$E = E_0 (1 + 2.5c + 14.1c^2) \quad (1)$$

where E is the modulus of elasticity of the sample containing the filler,  $E_0$  the modulus of the corresponding pure gum stock, and c, the volume concentration of the filler.

However, the effect of reinforcing carbon blacks is significantly higher than the prediction of equation 1. A combination of two effects can account for the unique behavior of carbon-black loaded samples.

(1) It has been shown that carbon black adsorbs preferentially certain fractions of rubber and that the fraction of the matrix between carbon black particles has a higher modulus than the original gum stock used.

(2) The volume of the carbon black is increased by this adsorbed layer of rubber and hence the volume, c, is larger than the volume of carbon black as added. It was of interest to gain information on the nature of the rubber layer surrounding the carbon black particle. This was achieved by investigating the viscous properties of suspensions of carbon black in GR-S solutions. Thus information was gained on the thickness of the rubber layer, its rigidity and the shift in concentration of rubber in respect to solvent



as compared to the concentration of the solution in adsorption equilibrium with the rubber covered carbon black surface.

By applying the relation,

$$\eta = \eta_0 (1 + 2.5c + 14.1c^2)$$

(in which  $\eta$  is the viscosity of the suspension, and  $\eta_0$  the viscosity of the rubber solution) the actual volume of carbon plus adsorbed rubber,  $c$ , was determined. The viscosity of the solution was measured after the filler particles and adsorbed rubber were centrifuged out.

Two different viscosimeters were employed. First a modified commercial Stormer was used and then a Couette-type instrument was designed and constructed. The latter eliminated the defects in the Stormer. By suspending in air magnetically, the cylinder, which acted against a watch spring, the errors due to friction at pivot points or bearings were eliminated. The liquid cup is driven by an isolated synchronous motor through a Selsyn drive, thus eliminating a direct coupling of a gear system which may introduce vibration. This instrument provided a wide range of shear rates.

The Stormer instrument failed to give Newtonian curves for liquids whose behavior was known to be Newtonian. These same liquids were Newtonian when tested on the magnetically suspended viscosimeter.

Microfilm copy of complete manuscript of 120 pages, \$1.50. Enlargements 6" x 8", 10¢ per page.

#### THE EFFECT OF ATMOSPHERIC GASES ON THE INTERFACIAL TENSIONS BETWEEN MERCURY AND SEVERAL LIQUIDS

(Publication No. 3712)

Richard James Bard, Ph.D.  
University of Michigan, 1951

In the past definite, single values have been reported for the interfacial tensions between mercury and a large number of "pure" liquids in unpolarized systems. In most cases no indication was given of the removal of dissolved air from the systems. Recently in this laboratory it was demonstrated (Bjorklund, C. W., Thesis, University of Michigan, 1950) that the interfacial tensions between mercury and each of two liquids, water and benzene, were dependent upon the time of contact of mercury with the contiguous liquid whenever dissolved air was present. The present investigation of mercury-liquid interfacial tensions in unpolarized systems was undertaken to determine (a) the effect of atmospheric gases, (b) the significance of the definite, single values reported in the literature and (c) the conditions under which equilibrium interfacial tension values can be obtained.

The pendent drop method of measuring fluid-fluid boundary tensions was adapted to the measurement of mercury-liquid interfacial tensions under specially controlled conditions. New methods for the prepara-

tion of systems for measurement were devised. Time studies of interfacial tension were employed throughout. The mercury-water system was studied (1) in the presence of laboratory air, (2) in the absence of dissolved gases, (3) in the presence of several inactive gases, (4) in the presence of oxygen and (5) in the presence of several mixtures of oxygen and carbon dioxide. The mercury-n-heptane system and the mercury-benzene system were investigated (1) in the presence of laboratory air, (2) in the absence of dissolved oxygen, (3) in the presence of oxygen and (4) with the hydrocarbon saturated with oxygen-free and carbon dioxide-free water. The effect of oxygen on the interfacial tension between mercury and ethyl alcohol was also studied.

A readily reproducible value for the initial interfacial tension between mercury and water was obtained in all deoxygenated systems. This value was identified as corresponding to mercury at its potential of instantaneous immersion in water and at the potential of the electrocapillary maximum of the mercury-water system. Oxygen was found to have a pronounced effect in systems containing liquids which support ionization. It was shown that in the absence of an applied potential and in the initial absence of potential-determining ions such systems nevertheless assume the properties of electrocapillary systems as a result of chemical interaction between mercury and dissolved oxygen. Some of the results of the present investigation were shown to be predictable from existing electrode potential and electrocapillary data. The absence of oxygen effect for mercury in contact with non-polar liquids proved the ionic character of the reaction. The data on the combined effects of oxygen and carbon dioxide enabled a quantitative explanation of the low values previously reported for the interfacial tension between mercury and water.

It is concluded that the corrosion of mercury in contact with aerated liquids which support ionization and the resulting electrocapillary effects must be considered in the measurement of interfacial tension in such systems and that the definite, single values reported in the literature for such systems provide an insufficient description of the systems upon which the measurements were made. It is also concluded that equilibrium values of interfacial tension in such systems can be obtained only after the electrochemical requirements for equilibrium have been satisfied.

Microfilm copy of complete manuscript of 150 pages, \$1.88. Enlargements 6" x 8", 10¢ per page.

#### A COMPARISON OF THREE SCHEDULE PATTERNS IN THE TEACHING OF GENERAL CHEMISTRY

(Publication No. 3873)

David James Blick, Ph.D.  
Columbia University, 1952

#### The Problem

This study represents an attempt to determine the

relative effectiveness of three schedule patterns in the teaching of General Chemistry at the University of Connecticut. The three patterns are: Pattern A. Two one-hour lecture periods per week and two two-hour laboratory periods per week; Pattern B. Three one-hour lecture periods per week and one three-hour laboratory period per week; Pattern C. Two one-hour lecture periods per week, one one-hour recitation period per week, and one three-hour laboratory period per week. Each pattern involved a total of six hours of student time per week.

#### Procedure

Students were taught under Pattern A during 1945-46, under Pattern B during 1946-47, and under Pattern C during 1947-48. At the end of each academic year, the students were given the A. C. S. Cooperative General Chemistry Test for College Students. For the year 1945-46, Form 1942 was used, and for the years 1946-47 and 1947-48, Form 1946 was used. The two forms of the test were equated by administering both forms to the General Chemistry class in June, 1949. The data indicated that the two forms were comparable in difficulty.

The three groups studied were matched by use of the Neyman-Johnson Technique. This method of matching, using matched subgroups instead of individuals, has certain advantages over the traditional method. It is more likely to produce samples which are more representative of the original population, and it prevents loss of much valuable information.

#### Findings

The important findings of this study were:

1. Student achievement under Pattern B was significantly higher than under Pattern A.
2. Student achievement under Pattern C was higher than under Patterns A or B. The difference in achievement between Pattern B and Pattern C is not statistically significant. The difference in achievement between Pattern A and Pattern C is highly significant in favor of Pattern C.
3. Student achievement in the laboratory as measured by the tests used was slightly lower under Patterns B and C than under Pattern A. Student achievement in the laboratory as judged by the instructor and assistants in terms of written experiments and results on qualitative unknowns was essentially the same under the three patterns.

#### Conclusion

Pattern C is a more efficient time pattern than either Pattern A or Pattern B when efficiency is measured by the A. C. S. Cooperative General Chemistry Test for College Students. While student achievement under this pattern is not significantly superior to that under Pattern B, this pattern permits more efficient use of staff and instructional facilities. Pattern C is much more efficient than Pattern A.

#### Implications for further study

Many classes are arranged on schedule patterns which have no basis other than tradition. These

patterns may not be the best either in facilitating student achievement or in terms of efficient staff utilization. Much research remains to be done in this area.

Microfilm copy of complete manuscript of 64 pages, \$1.00. Enlargements 6" x 8", 10¢ per page.

#### THE USE OF A ROTATING SECTOR IN THE ELECTRON DIFFRACTION DETERMINATION OF THE MOLECULAR STRUCTURES OF THREE METHYL SILANES

(Publication No. 3718)

Arthur Chalmer Bond, Ph.D.  
University of Michigan, 1952

The purpose of this investigation was to compare the "visual" method of interpreting electron diffraction data with a more objective sector-microphotometer method in the determination of the structures of mono-, di-, and tri-methyl silane. Interest in the methyl silanes arises from the large range of values reported for the Si-C distances in other silicone-carbon compounds which suggests a surprising sensitivity of this bond distance to the other atoms attached to the silicon atom. The new methyl silanes afford a test of the effects of added methyl groups on the Si-C distance. A test of the visual method was made because of the failure of this method to yield unambiguous results in the determinations of certain molecules.

In the visual method the diameter of the rings on unsectored plates were measured and their intensity estimated visually. These measurements were then used to calculate a radial distribution curve which gave some indication of interatomic distances occurring in the three molecules. Theoretical curves for various assumed models were calculated and compared with the visual measurements.

The sector-microphotometer method involved the use of an  $r^3$  sector, rotated in front of the photographic plate during the exposures. Microphotometer records, from which experimental intensity curves could be obtained, were then taken. These experimental curves were used in the calculation of radial distribution curves and in the comparison with theoretical curves of assumed models.

The results for the sector-microphotometer method proved to be superior to visual results in several respects. The radial distribution curves based on sector-microphotometer data gave values for all of the important interatomic distances occurring in the three molecules while those based on the visual data gave a reliable value for only the Si-C distance. Furthermore, the sector-microphotometer radial distribution curves permitted an objective determination of interatomic vibrational amplitudes which are very important in the calculation of theoretical curves for the molecules studied. It was possible to assign much smaller limits on the precision of the determination of the various structural parameters by the sector-microphotometer method than is possible in the most visual analysis.



It was possible to conclude, on the basis of sector-microphotometer data, that there is a small increase of 0.01Å in the Si-C distance in going from dimethyl to trimethyl silane. It was also concluded that some of the previous work on silicon-carbon compounds should be repeated using the sector-microphotometer method in order to establish more quantitatively the effect of the addition of various atoms on the Si-C bond distance.

Microfilm copy of complete manuscript of 72 pages, \$1.00. Enlargements 6" x 8", 10¢ per page.

**ADSORPTION OF VAPORS BY SILICA GELS  
OF DIFFERENT STRUCTURES  
FREE SURFACE ENERGY CHANGES WHICH  
OCCUR DURING ADSORPTION BY POROUS  
ADSORBENTS**

(Publication No. 3720)

John Edwin Bower, Ph.D.  
University of Michigan, 1952

The general aim of this research was to provide a firmer foundation for the use of the Gibbs adsorption equation for the evaluation of energy changes which occur when vapors or liquids are brought into contact with porous solids. A series of porous adsorbents of similar chemical nature but differing from each other in respect to pore radius, pore volume and surface area were used with a series of adsorbate liquids which it was believed would give quite different interaction energies with the adsorbent.

A modified McBain-Bakr quartz spiral balance technique was used for obtaining isotherms for the adsorption of the vapors of methyl alcohol, ethyl alcohol, n-propyl alcohol, benzene, carbon tetrachloride, hexane and water on three silica gels of different apparent densities.

The specific surface area of each gel was determined by the application of the conventional B.E.T. equation using adsorption data of nitrogen at -195°C.

The free surface energy changes which occurred during adsorption were calculated from the data of each of the gravimetrically determined isotherms by integration of the Bangham modification of the Gibbs adsorption equation. The free surface energy change which occurred when a given solid-air interface was replaced by a solid-liquid interface (the adhesion tension) was determined as was also that which occurred when the "clean" solid-air surface was replaced by a given solid-saturated vapor interface (the initial spreading coefficient). The adhesion tension values thus obtained were in good agreement with values which were found in, or obtainable from, data available in the literature. The investigation disclosed also that the adhesion tension values of a given liquid against the different silica gels were approximately the same.

The isotherms were shown to fit best that theory which postulates that the process of adsorption by porous solids consists of a combination of two disparate phenomena, multi-layer adsorption and capillary condensation.

Application of the Kelvin equation to the adsorption data for different liquids on a given gel gave highly concordant values for the average capillary radius of the gel. This radius was interpreted to be the radius of the open pore at the inception of capillary condensation, i.e. the radius after one or more layers had been adsorbed. Good agreement, also, was obtained in the values of the average "dry" pore radius, determined by (a) treatment of the capillaries as uniform cylinders, and (b) by addition of the calculated multi-layer thickness to the Kelvin radius.

The method of Bartell and Fu for calculating the surface area of porous adsorbents was found to give good agreement with (a) the B.E.T. nitrogen area method and (b) with the method based on the assumption of circular pores, i.e.  $\text{area} = \frac{2V_s}{R}$ .

Differential isosteric heats of adsorption were determined for benzene and for ethyl alcohol with one of the gels. The heat of adsorption was found to approach the heat of condensation of the adsorbate after approximately two statistical layers had been adsorbed.

Combination of adhesion tension values, calculated from the isotherms, with calorimetric heat of wetting data permitted evaluation of the temperature coefficient of the adhesion tension. The heats of wetting of two gels by a given liquid were found to be in the same ratio as their surface areas.

It is concluded that the use of the Gibbs adsorption equation for the evaluation of free surface energy changes per unit area which occur during adsorption on porous adsorbents is justifiable and that the energy changes so calculated are, within rather wide limits, independent of the physical structure of the adsorbent.

Microfilm copy of complete manuscript of 220 pages, \$2.75. Enlargements 6" x 8", 10¢ per page.

**SELECTED REACTIONS OF THE  
ISOMERIC CHLOROETHYLTRIALKOXYSILANES**

(Publication No. 3664)

Frederick C. Boye, Ph.D.  
University of Buffalo, 1952

According to the procedure of Sommer and Whitmore (1), the isomeric chloroethyltrichlorosilanes were prepared. These were reacted with certain alcohols (2) to give the respective chloroethyltrialkoxysilanes, hitherto uninvestigated.

The first reaction studied was that of hydrolysis of the chloroethyltrialkoxysilanes to disiloxanes. In two cases, hydrolysis occurred during the preparation of chloroethyltrialkoxysilanes via a postulated side reaction. At other times, a known quantity of water was present. Comparatively low yields (15-52%) were attributed to the formation of polysiloxanes.

Secondly, disproportionation was brought about in the  $\beta$ -chloroethyltrialkoxyl series by reacting two members having different alkoxyl groups. In all cases but one, two possible products were isolated. Approximately 20% of the alkoxyl was accounted for in the products.

Thirdly, reaction of acetic anhydride with the  $\beta$ -chloroethyltrialkoxysilanes caused replacement of one or two alkoxy groups by acetate. Factors contributing to the conservative yields were: difficult separation of similarly boiling products, richness of the mixture in the product sought (which depended on time and proportions), and the fact that this was an equilibrium type reaction.

Fourthly, a similar replacement of alkoxy by propionoxy through propionic anhydride was investigated. Three products were prepared in yields of 14-31%.

In the  $\alpha$ -chloroethyltrialkoxyl series, replacement of the chlorine by alkoxy was seen to occur through the medium of sodium alkoxide. In three cases, when alkoxide matched alkoxy of silane, disproportionation was prevented and yields of the expected ether were as high as 61%. In other cases, disproportionation of alkoxy groups led to lower yields. A few products of disproportionation were isolated.

1. F. Whitmore and L. Sommer, *J. Am. Chem. Soc.*, **68**, 485 (1946).

2. F. Boye and H. Post, *J. Org. Chem.*, **16**, 391 (1951).

Microfilm copy of complete manuscript of 53 pages, \$1.00. Enlargements 6" x 8", 10¢ per page.

#### STUDIES ON THE DEGRADATION OF NEOERGOSTEROL AND RELATED SUBSTANCES

(Publication No. 3730)

Michael Patrick Cava, Ph.D.  
University of Michigan, 1952

The purpose of this investigation was to study reactions which could be used to degrade the steroid neoergosterol to the corresponding 17-ketone, 5, 7, 9-estratrien-3 $\beta$ -ol-17-one. This ketone has never been obtained by an unequivocal route either by total synthesis or by degradation of a more complex molecule, although its structure has been assigned in the past to two very different compounds, the first a physiologically inactive substance isolated from equine urine and the second, a potent estrogen resulting from an unspecific series of reactions on neoergosterol.

Neoergosterol has been found to possess a *trans* double bond in the side-chain, and neoergosterol dibromide has proved to be the 22,23-dibromide.

The ozonization of neoergosterol acetate gave unpromising results. The hydroxylation of neoergosterol acetate with osmium tetroxide gave in high yield threo-22,23-dihydroxyneoergosterol, which could be obtained crystalline after chromatography. Oxidation of threo-22,23-dihydroxyneoergosterol with periodic acid gave, in excellent yield,  $\alpha$ -(3 $\beta$ -hydroxy-5,7,9-estratrien-17-yl)-propionaldehyde, easily acetylated to its 3-acetoxy derivative.

Bromination of the latter compound produced an  $\alpha$ -bromoaldehyde, which was dehydrobrominated by 2,4-dinitrophenylhydrazine to give the unsaturated aldehyde,  $\alpha$ -(3 $\beta$ -acetoxy-5,7,9-estratrien-17-yl)-propionaldehyde as its 2,4-dinitrophenylhydrazone. Several attempts at degrading this substance were not successful.

A number of reactions were studied which were hoped to be of use in the degradation of the remaining three carbon atoms of the side-chain of neoergosterol.

A general procedure was worked out for the oxidation of amines to ketones or aldehydes, through the intermediary formation of chloramines and imines. By this method the following carbonyl compounds were produced: 5-pregnenolone, fluorenone, phenylacetaldehyde, hexahydrobenzaldehyde, benzaldehyde and cyclohexanone.

The enol acetates of isobutyraldehyde, cyclohexyl methyl ketone and cyclohexanone were prepared and converted into their hitherto unknown epoxides. 1-Acetoxy-cyclohexene oxide was reduced by alkaline aqueous sodium borohydride to give cyclohexanediol-1,2. The enol acetate of  $\alpha$ -(3 $\beta$ -acetoxy-5,7,9-estratrien-17-yl)-propionaldehyde was obtained only in amorphous condition and could not be further degraded with positive results.

Both the Schmidt degradation of 5-pregnenolone acetate and the Beckmann rearrangement of 5-pregnenolone acetate oxime produced 17 $\beta$ -acetamido-3 $\beta$ -acetoxy-5-androstene. This compound proved to be identical with the acetyl derivative of the amine which resulted when 3 $\beta$ -acetoxy-5-etiocholenic acid was subjected to a Curtius reaction.

Androstanediol-3 $\beta$ ,17 $\beta$  was obtained by the oxidation of allopregnan-3 $\beta$ -ol-20-one with performic acid.

The side-chain of 17 $\alpha$ -hydroxy-allopregnan-3 $\beta$ -ol-20-one was removed, with the formation of t-androsterone, by reduction with sodium borohydride followed by oxidation with periodic acid.

Cinnamaldehyde was regenerated quantitatively from its 2,4-dinitrophenylhydrazone by pyruvic acid. This reaction is the first one of its kind known involving the regeneration of an aldehyde.

The oxidation of cinnamaldehyde by alkaline hydrogen peroxide was found to produce sodium phenylglycidate, attack on both the aldehyde group and the olefinic double bond having occurred.

Microfilm copy of complete manuscript of 128 pages, \$1.60. Enlargements 6" x 8", 10¢ per page.

#### SUBSTITUTED ACETHYDRAZONES OF 5-NITROFURFURAL II

(Publication No. 3831)

Murray Samuel Cohen, Ph.D.  
University of Missouri, 1952

The branched chain and straight chain fatty acids, long chain quaternary ammonium salts and derivatives of 5-nitrofurfural are known to possess antibacterial properties. This investigation was undertaken to



incorporate three of these groupings in the same molecule. Two compounds have been prepared, each from two different homologous series, which represented the reaction products from the hydrazides of trimethyl-10-carbethoxydecylammonium bromide and trimethyl-(4-methyl-14-carbethoxy)-(tetradecylammonium bromide with 5-nitrofurfural. A number of interesting side reactions which occurred in the preparation of the above compounds were investigated and some of the products of these reactions have been studied further and characterized.

The syntheses are divided into two series. Series I used 11-bromohendecanoic acid as the starting material. This acid was esterified and the quaternary ammonium salt was formed by treating it with trimethylamine in ethereal solution. The carbethoxy group was then made to react with hydrazine hydrate to give the hydrazide of trimethyl-10-carbethoxydecylammonium bromide. The final product of this series was obtained when the hydrazide of trimethyl-10-carbethoxydecylammonium bromide was treated with 5-nitrofurfural. An oil resulted which was difficult to purify, but it was obtained finally in crystalline form from pyridine.

The same starting material was employed in Series II; however, an elaborate synthetic procedure was required to arrive at the final product. The branching of the acid portion of the molecule was achieved in the following manner: 11-bromohendecanoic acid was converted to the acid chloride and this product, when condensed with dimethylcadmium, resulted in the formation of methyl 10-bromodecyl ketone. The ketone was caused to react with  $\gamma$ -ethoxypropylmagnesium bromide, but the product from this reaction, 3-ethoxypropyl-10-bromodecylmethylcarbinol, was not isolated; instead it was dehydrated directly to the mixture of olefins, 4-methyl-1-ethoxy-14-bromotetradecene-3 and -4. This mixture was then converted to a mixture of 4-methyl-1-ethoxypentadecene-11-oic acid and 4-methyl-1-ethoxypentadecene-12-oic acid by two different paths. The first, direct carbonation of the long chain Grignard reagent, gave only fair yields. The second procedure, which was accomplished through the nitrile followed by hydrolysis, was found to be superior. These acids were hydrogenated at high pressure using a Raney nickel catalyst to give the homogeneous product, 15-ethoxy-12-methylpentadecanoic acid, which was treated with hydrogen bromide in a sealed bottle to effect the cleavage of the ether grouping. The bromo acid was esterified and reacted with trimethylamine to obtain the quaternary ammonium salt, trimethyl-(4-methyl-14-carbethoxy)-tetradecylammonium bromide. This compound was not isolated due to its extreme deliquescence. The remaining reactions were similar to those of Series I. Trimethyl-(4-methyl-14-carbethoxy)-tetradecylammonium bromide was treated with hydrazine hydrate and the resulting hydrazide was condensed with 5-nitrofurfural.

It was found that when  $\gamma$ -phenoxypropyl halides were treated with magnesium an elimination reaction occurred which resulted in the formation of cyclopropane and magnesium phenoxide. The cyclo-

propane was characterized by cleaving the ring with bromine and isolating 1,3-dibromopropane. The reaction did not occur with  $\gamma$ -ethoxypropyl bromide but treatment of the Grignard reagent of this compound with anhydrous cadmium chloride brought about a similar result.

Contrary to expectation, it was also found that the dimethylcadmium reagent, when used in excess, reacted with an acid chloride in the same manner as does the Grignard reagent.

Microfilm copy of complete manuscript of 94 pages, \$1.18. Enlargements 6" x 8", 10¢ per page.

#### PREFERENTIAL CAPILLARY ADSORPTION OF WATER FROM SOLUTIONS OF ALCOHOLS BY SILICA GEL

(Publication No. 3740)

Daniel Joseph Donahue, Ph.D.  
University of Michigan, 1951

Data were obtained for the adsorption of water from n-butyl, n-amyl, n-hexyl, and n-heptyl alcohol solutions by silica gel at 0°, 25°, and 45° C. The Karl Fischer method of water analysis was used for the determination of the concentration of the solutions. The specific surface area, pore volume, and pore radius of the silica gel were also determined by recognized methods. The amounts of water adsorbed were plotted against reduced concentrations, (i.e. the equilibrium concentrations divided by the concentrations of the saturated solutions). The sigmoid type isotherms obtained for the adsorption of water from the different solvents were found to be very similar in shape.

The Brunauer, Emmett, and Teller (BET) equation, which was derived for adsorption of gases, was found to be applicable also to the adsorption of water from the solutions of alcohols. The constants of the BET equation were studied in relation to their application in the adsorption from solution and they appeared to represent the physical significance which had originally been assigned to them. A kinetic model for the mechanism of multimolecular adsorption of water from solution was proposed. By employing concepts fundamental to this model the heats of adsorption of the first and subsequent layers were calculated by using the BET constant  $c'$  together with the heat of solution of water in the solvents.

The large apparent adsorption observed in the high concentration region of the isotherms indicated that a process analogous to capillary condensation of gases must have occurred. Evidence was obtained which indicated that the rapid increase in apparent adsorption resulted from the separation of a water rich phase within the capillaries of the silica gel.

Study of adsorption of water by silica gel has shown that the extent of dehydration by silica gel increases rapidly with the decrease of the solubility of the water in the solvent.

A brief review of the theories of membrane semi-

permeability was presented. The large apparent adsorption of water observed in the high concentration region of the isotherms gives strong support to the preferential adsorption theory of membrane semipermeability. It was found that because of its preferential adsorption water displaced other components from the capillaries of hydrophilic gels and thus prevented the passage of other components through the capillaries. In a continuous gel membrane preferential adsorption effects could account for the semipermeability of the membrane.

A supplement of this dissertation presents the results obtained in a study of factors which contribute to the interfacial tension which exists at a water-organic liquid boundary. The interfacial tensions at such boundaries were found to be directly related to the "degree of miscibility" of the two components. For water-organic liquid systems Antonoff's rule was shown to be valid only when applied to systems containing organic liquids which form no lenses or at most lenses which have very low angles of contact on water (approximately  $10^\circ$  or less).

Microfilm copy of complete manuscript of 138 pages, \$1.73. Enlargements 6" x 8", 10¢ per page.

#### STUDIES ON THE DEGRADATION OF THE A RING OF EQUILENIN AND RELATED COMPOUNDS

(Publication No. 3755)

Thelma Eskin Habgood, Ph.D.  
University of Michigan, 1952

This investigation was concerned with a study of the reductive cleavage of the substituted ring of o-naphtholic carboxylic acids and the recyclization of the resulting dicarboxylic acids into ketones with the idea of utilizing these reactions for the opening of the aromatic A ring of equilenin and recyclizing to an alicyclic ring.

Three o-naphtholic carboxylic acids were thoroughly investigated, namely, 2-hydroxy-1-naphthoic acid, 2-hydroxy-3-naphthoic acid, and 2-hydroxy-5,6,7,8-tetrahydrophenanthrene-1-carboxylic acid, the latter a new compound.

$\beta$ -Naphthol was converted into 2-hydroxy-1-naphthoic acid either by means of a new modification of the Kolbe-Schmitt reaction, or by silver oxide oxidation of 2-hydroxy-1-naphthaldehyde, prepared by the action of hydrogen cyanide on  $\beta$ -naphthol. The dicarboxylic acid, o-carboxymethyl hydrocinnamic acid, was prepared by reduction with sodium and n-amyl alcohol of 2-hydroxy-1-naphthoic acid, 2-hydroxy-3-naphthoic acid, 2-methoxy-3-naphthoic acid, and methyl 2-hydroxy-3-naphthoate. The ketone,  $\beta$ -tetralone, was prepared from the dicarboxylic acid by pyrolysis of its thorium salt. The direction of ring closure in the Dieckmann cyclization of the dimethyl ester of o-carboxymethyl hydrocinnamic acid was shown to occur in such a way as to

yield 1-carbomethoxy-2-tetralone, thus providing a new synthesis of 1-alkyl-2-tetralones.

In a similar manner, 2-hydroxy-5,6,7,8-tetrahydrophenanthrene-1-carboxylic acid, prepared by the modified Kolbe reaction from 7-hydroxy-1,2,3,4-tetrahydrophenanthrene, was reduced with sodium and n-amyl alcohol to the new dicarboxylic acid, 1- $\beta$ -carboxyethyl-2-carboxymethyl-5,6,7,8-tetrahydrophenanthrene. The new ketone, 2-keto-1,2,3,4,5,6,7,8-octahydrophenanthrene was obtained by two different routes; either by a Dieckmann cyclization of the dimethyl ester of the dicarboxylic acid followed by decarboxylation, or by sodium and ethyl alcohol reduction of 7-methoxy-1,2,3,4-tetrahydrophenanthrene. This keto-octahydrophenanthrene was shown to be readily oxidizable by isolation of the p-nitrophenylhydrazone of 2-hydroxy-1-keto-1,2,3,4,5,6,7,8-octahydrophenanthrene, and by formation from the ketone of another new dicarboxylic acid, 1- $\beta$ -carboxyethyl-2-carboxy-5,6,7,8-tetrahydrophenanthrene. The latter, by pyrolysis, formed another new ketone, 3'-ketocyclopenteno-5,6,7,8-tetrahydrophenanthrene.

Some progress was made in the study of the cleavage of the A ring of equilenin. 4-Carbomethoxyequilenin, a valuable intermediate in the reductive cleavage, was prepared for the first time. Other intermediates prepared were 4-formylequilenin, made by the action of hydrogen cyanide on equilenin, and 4-formylequilenin methyl ether, both new compounds. The modified Kolbe reaction with equilenin was studied. A new compound derived from 17 $\beta$ -dihydroequilenin, namely, 17 $\beta$ -dihydroequilenin methyl ether acetate was prepared. 4-Hydroxyequilenin was synthesized for the first time, starting with 4-formylequilenin.

Microfilm copy of complete manuscript of 83 pages, \$1.04. Enlargements 6" x 8", 10¢ per page.

#### THE SYNTHESIS OF NITROGEN MUSTARD DERIVATIVES OF SOME STEROIDS AND RELATED COMPOUNDS

(Publication No. 3761)

George Gustave Hazen, Ph.D.  
University of Michigan, 1952

The purpose of this work was to prepare nitrogen mustard derivatives of some steroids and related compounds.

Cholesteryl chloride, cholesteryl and stigmasteryl p-toluenesulfonates, and ergosteryl methanesulfonate were condensed with diethanolamine to give N-bis-(2-hydroxyethyl)-3-cholesterylamine, N-bis-(2-hydroxyethyl)-3-stigmasterylamine and N-bis-(2-hydroxyethyl)-3-ergosterylamine respectively.

The N-bis-(2-hydroxyethyl)-amino-steroids were transformed to the hydrochlorides of the nitrogen mustards, N-bis-(2-chloroethyl)-3-cholesterylamine, N-bis-(2-chloroethyl)-3-stigmasterylamine and N-bis-(2-chloroethyl)-3-ergosterylamine, by reaction with



thionyl chloride. The free amines which were unstable in aqueous media, were liberated by passing non-aqueous solutions of the hydrochlorides through an alumina column. The use of pinene to take up the hydrogen chloride formed in the preparation of N-bis-(2-chloroethyl)-3-ergosterylamine reduced the formation of undesirable by-products.

The properties of the new cholesterylamines were compared with those of the known N-benzyl-3-cholesterylamine and N-benzyl-6*i*-cholesterylamine. It was found that the *i*-steroid added no bromine at 0° while N-benzyl-3-cholesterylamine added one mole of bromine under the same conditions. The new amines also added one mole of bromine and hence were normal (C-3) steroids. The N-bis-(2-hydroxyethyl)-3-stigmasterylamine was shown to add 2 moles of bromine at 0° and therefore was a normal (C-3) steroid. The Liebermann-Burchard reaction, hydrogenation, permanganate (Baeyer) test and reaction with perbenzoic acid were found not to distinguish between the *i*- and normal steroid amines.

The orientation of the amino groups in the nitrogen mustard derivatives of cholesterol and stigmasterol are considered to be beta by analogy to the similarly prepared beta oriented ethers.

N-3-cholesteryl morpholine was prepared by two methods, the condensation of cholesteryl *p*-toluenesulfonate with morpholine and by the dehydration of N-bis(2-hydroxyethyl)-3-cholesterylamine.

Triformyl cholic acid was degraded to an amine by the Curtius reaction using acetic acid. It appeared that even under these mild conditions the labile 3 and 7 formyl groups were lost and that the product was 3,7-dihydroxy-12-formoxy-23-aminonorcholane.

2-Chloroethyl *p*-toluenesulfonate was found to react with N-methylaniline to give N-(2-chloroethyl)-N-methylaniline. However, the expected nitrogen mustard, N-bis-(2-chloroethyl)-*n*-butylamine, could not be isolated from the reaction of *n*-butylamine and 2-chloroethyl *p*-toluenesulfonate.

Condensation of 8-bromoguanine with diethanolamine produced 8-[bis-(2-hydroxyethyl)-amino]-guanine.

Microfilm copy of complete manuscript of 98 pages, \$1.23. Enlargements 6" x 8", 10¢ per page.

#### KINETICS OF ELIMINATION REACTIONS OF DIHALOETHYLENES AND THE MECHANISM OF TRANS ELIMINATION

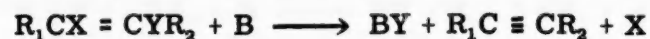
(Publication No. 3689)

Sidney Israel Miller, Ph.D.  
Columbia University, 1951

In bimolecular elimination reactions, groups located in trans positions are removed more easily than those located in cis positions. No exceptions to this "trans elimination" rule are yet available. In this study, quantitative data on the elimination reactions of  $C_2H_2Cl_2$ ,  $C_2H_2Br_2$ , and  $C_2H_2I_2$  with

$CH_3ONa$ , and of  $C_2H_2I_2$  with  $NaI$ , provide new evidence favoring trans over cis elimination in geometrical isomers.

We can represent such reactions rather generally



Trans elimination in any such pair can be correlated, not only with higher rate constants, but also, in the cases examined, with the lower free energies of the activated state. The approximate relative rates of trans to cis elimination in the reactions of  $CH_3ONa$  with the  $C_2H_2X_2$  isomers are 7200:1,  $1.2 \times 10^6$ :1 and  $10^6$ :1 when X is Cl, Br, and I, respectively. The rate of trans elimination from trans  $C_2H_2I_2$  is greater by a large but unknown factor than the rate of elimination from the other isomer. Moreover, the data for the trans eliminations are far more reliable than the data for the cis eliminations. At the higher temperatures required for the cis eliminations it appears that the velocities of complicating side reactions become significant.

The view that trans elimination of  $C_2H_2X_2$  with  $CH_3ONa$  goes by a concerted mechanism has been deduced from the absence of trends in the kinetic data and from the absence of isomerization. We observed  $E_{exp.} = 24.7, 28.1, \text{ and } 35.1 \text{ kcal}$  when X is I, Br, and Cl, respectively, and  $\Delta S^* = 14, 16, \text{ and } 22 \text{ e.u.}$  for the same series of trans eliminations. These data have been correlated with the aid of the concerted mechanism.

No evidence has been found experimentally for or against concerted cis eliminations, nor have two-step mechanisms been established in these cases. Evidence from the literature suggests that ethylenic carbanions exist, but do not racemize as readily as has sometimes been supposed.

We consider that the first step in the cis eliminations with  $CH_3ONa$  involves the removal of a proton. We observed  $E_{exp.} = 29, 33.3, \text{ and } 36 \text{ kcal}$  when X = Cl, Br, and I, respectively, and  $S^* = -12, +6, \text{ and } +25 \text{ e.u.}$  for the same series. These data can be correlated with the stage-wise mechanism.

The data for the reaction



were  $E_{exp.} = 29.4 \text{ kcal}$  and  $S^* = -4 \text{ e.u.}$  for the trans elimination, and  $E_{exp.} = 19.5 \text{ kcal}$  and  $S^* = -24 \text{ e.u.}$  for the trans addition. Presumably the decomposition of cis  $C_2H_2I_2$  with  $I^-$  is slow primarily because of a high energy of activation.

No pattern of activation energies or entropies is evident for all pairs. The entropy effects for several of these reactions are much larger than might be anticipated for reactions between ions and neutral molecules. Furthermore, these effects depend greatly on the nature of the solvent and to some extent parallel changes in the activation energy.

No correlation between differences in activation energy in any cis-trans pair and their relative thermodynamic stability could be found. Gross dipole forces or steric effects have been shown to be minor compared to the valence forces operating in these eliminations. A "mechanical" description of these eliminations has been made; the linear nature of the

departing groups in the transition state of the favored trans elimination has been stressed. Such a model is analogous to the linear transition state of a Walden inversion and the planar transition state for eliminations in cyclic systems: nucleophilic attack on carbon, from the rear, occurs in all these cases.

Evidence from three sources, kinetics, infrared, and phase studies, has shown that the material commonly accepted as *cis* C<sub>2</sub>H<sub>2</sub>I<sub>2</sub> is a eutectic mixture containing twenty percent of the trans isomer. A photochemical method for the preparation of this *cis* eutectic has been introduced. The elimination reaction of I<sup>-</sup> with 1,2-dihalides has been extended from saturated to unsaturated compounds and has been useful in the partial purification of *cis* eutectic C<sub>2</sub>H<sub>2</sub>I<sub>2</sub>.

Microfilm copy of complete manuscript of 109 pages, \$1.36. Enlargements 6" x 8", 10¢ per page.

#### THE PREPARATION AND PROPERTIES OF CERTAIN ALKYL AND ALKOXY DERIVATIVES OF VINYLTRICHLOROSILANE

(Publication No. 3665)

Roger M. Nagel, Ph.D.  
University of Buffalo, 1952

The reaction of a Grignard reagent and vinyltrichlorosilane



was employed to prepare a series of vinyltrialkylsilanes. It was not possible to produce the branched-chain trialkyl derivatives by this method. Steric hindrance and the retarding effect on the reaction rate by the solvent, diethyl ether, have been offered as an explanation for this failure. An alternative procedure involving the use of organic lithium compounds was proposed. The introduction of three cyclohexyl groups was also unsuccessful. Vinyltrichlorosilane was found to react with methyl-, ethyl-, propyl-, butyl-, amyl-, allyl-, phenyl-, and benzyl-magnesium bromide, respectively, giving the following percentage yields of vinyltrialkylsilanes: 91.4, 52.3, 51.0, 61.8, 45.6, 51.8, 34.0, 37.8. Vinyltriethylsilane has been previously reported as a by-product from a different reaction.

Experimental molar refraction values for three of the vinyltrialkylsilanes were obtained which deviated from the calculated values by more than one percent. An explanation for these inconsistent results has been presented.

Anhydrous alcohols were reacted with vinyltrichlorosilane



to yield a series of vinyltrialkoxysilanes. In one case a disiloxane was recovered. Only *t*-butyl alcohol failed to react to give the trialkoxy derivative. Here again, steric factors were believed to be the cause. By this method 17 new compounds have been

prepared in this work. The following trialkoxy derivatives with their percentage yields were isolated: methoxy, 55.2; ethoxy, 50.4; propoxy, 73.0; *i*-propoxy, 63.0; butoxy, 64.2; *s*-butoxy, 71.7; *i*-butoxy, 61.6; amoxy, 64.5; *i*-amoxy, 68.0; hexoxy, 66.5; heptoxy, 52.9; octoxy, 43.3; alloxy, 64.8;  $\beta$ -chloroethoxy, 66.1;  $\beta$ -methoxy-ethoxy, 46.0; cyclohexoxy, 66.7; and phenoxy, 61.7.

A modification of the above-mentioned method was also carried out. This procedure utilized pyridine to remove hydrogen chloride as it formed by precipitation of pyridine hydrochloride. Only two products were prepared by this procedure. Comparison of the percentage yield obtained by the two methods was made, although an adequate conclusion as to which provided the higher yield in most cases was not attained due to the lack of sufficient data.

The possibility of synthesizing numerous vinylsilanes containing mixed alkyl and alkoxy groups and polyalkoxy groups was established. One compound of each type has been prepared.

The ease with which bromine adds to vinylsilanes was also demonstrated in this work. Because of the great tendency for the dibromoethylsilanes to dehydrobrominate, the hydrogen bromide was completely removed by means of a strong organic base and the alpha bromovinylsilanes were recovered. A polyalkoxy, a trialkoxy, and a trialkyl derivative of this kind were synthesized. A stable tribromoethylsilane was also prepared by adding bromine to the alpha bromovinylsilane after it had been isolated.

Microfilm copy of complete manuscript of 77 pages, \$1.00. Enlargements 6" x 8", 10¢ per page.

#### APPROACHES TO THE SYNTHESIS OF TETRAHYDROPHENANTHRENE ANALOGS OF THE CORTICAL STEROIDS

(Publication No. 3812)

David Anson Tyner, Ph.D.  
University of Michigan, 1952

This study has involved two major problems: the preparation of suitable tetrahydrophenanthrene compounds by new or modified procedures and the development of a modified diazoketone synthesis whereby a suitable acid might be converted to an  $\alpha$ -ketol via the diazoketone and ketol formate.

Such a diazoketone synthesis using formic acid has been developed and used to prepare a series of phenacyl formates and alcohols; this method affords yields comparable to those obtained with acetic acid and has the advantages of proceeding under much milder conditions. In the preparation of these phenacyl compounds from the corresponding phenacyl halides it has been demonstrated that previously reported *p*-bromophenacyl and *p*-chlorophenacyl formates were erroneous and actually were the corresponding alcohols. These formates cannot be prepared by the general method of preparing phenacyl esters.

In the preparation of the tetrahydrophenanthrene



intermediates some of the compounds have been synthesized by new routes and the conditions of several reactions have been extensively studied.

2-Carbomethoxy-1-keto-1,2,3,4-tetrahydrophenanthrene has been prepared by the carbonation, followed by esterification of 1-keto-1,2,3,4-tetrahydrophenanthrene in a yield comparable to that obtained via the glyoxalate. In the carbonation study both solid and gaseous carbon dioxide, several strong bases, and a variety of experimental conditions were investigated. These procedures should be useful in the preparation of other cyclic  $\beta$ -ketoesters and particularly those which are sensitive to high temperatures or otherwise go poorly by the glyoxalate method.

Two  $\gamma$ -ketoacids, 1-keto-1,2,3,4-tetrahydrophenanthrene-2-acetic acid and 1-keto-1,2,3,4-tetrahydrophenanthrene-2- $\alpha$ -propionic acid, have been prepared by the alkylation of 2-carbomethoxy-1-keto-1,2,3,4-tetrahydrophenanthrene with the primary and secondary  $\alpha$ -bromoesters, methyl bromoacetate and ethyl  $\alpha$ -bromopropionate, under a variety of experimental conditions. It was found that the primary  $\alpha$ -bromoester, as would be expected, was the more reactive alkylating agent and that strong alkali was as effective as strong acid in the hydrolysis and decarboxylation of the alkylated  $\beta$ -ketoester.

2-Methyl-1-keto-1,2,3,4-tetrahydrophenanthrene-2-acetic acid has been prepared by the methylation of methyl 1-keto-1,2,3,4-tetrahydrophenanthrene-2-acetate. In this study, dimethyl sulfate, methyl iodide, several strong bases, and a variety of experimental conditions were used. In the case of this  $\gamma$ -ketoester it has been demonstrated that dimethyl sulfate was the more reactive methylating agent and that the methylation occurred at the tertiary carbon atom  $\alpha$  to the ketone carbonyl group. It was observed that the ester group was effectively cleaved by triphenylmethyl sodium in an anhydrous inert solvent even at  $-70^{\circ}\text{C}$ . These results provide a starting point for further studies on the reactions of  $\gamma$ -ketoesters.

The above three  $\gamma$ -ketoacids have been reduced to the corresponding desoxy acids.

The ketol procedures developed in the phenacyl series have been applied to the synthesis of 2-( $\omega$ -hydroxyacetyl)-1,2,3,4-tetrahydrophenanthrene, a simple analog of the cortical steroids. In addition, two other tetrahydrophenanthrene acids, 1,2,3,4-tetrahydrophenanthrene-2- $\alpha$ -propionic acid and 2-methyl-1,2,3,4-tetrahydrophenanthrene-2-acetic acid, have been prepared which will provide key intermediates for future work in preparing closer analogs of the cortical hormones.

Microfilm copy of complete manuscript of 147 pages, \$1.84. Enlargements 6" x 8", 10¢ per page.

# MICROTITRATION OF ZINC AND A STUDY OF POSTPRECIPITATION OF ZINC IN SEMI MICRO QUALITATIVE ANALYSIS

(Publication No. 3866)

Charles H. Wright, Ph.D.  
University of Missouri, 1952

The major problem in this thesis is that of stating methods which can be used in an objective way to evaluate the effectiveness of various separation procedures in semi micro qualitative analysis. These methods are applied to the study of a separation problem. The postprecipitation of zinc by mercuric sulfide was chosen for this study because it promised to be both complicated and interesting.

The thesis is divided into two parts; the first part dealing with the selection of a microtitration of zinc, and the second dealing with the postprecipitation of zinc with mercuric sulfide. Four microtitrations for zinc are considered and comparison of the accuracy, precision, and convenience of the methods is made. The titrations which are discussed are; a potentiometric titration of zinc using potassium ferrocyanide as the reagent, the titration of the zinc oxinate by means of bromine, the titration of zinc sulfide by means of iodine, and an argentimetric method in which zinc sulfide is replaced by an equivalent amount of silver sulfide and the silver is then titrated by means of potassium thiocyanate. The potentiometric method and the titration of the oxine are both accurate to within a per cent. The oxine method is the most convenient.

The second part of the thesis is devoted to a discussion of a number of experiments which are designed to show how the postprecipitation reaction might influence the results of a qualitative analysis and to demonstrate a number of factors which are known to modify the postprecipitation effect.

Experiments are discussed which show the effect of concentration of zinc, rate of flow and time of exposure of the solution to hydrogen sulfide, changing acidity of the solution, the effect of varying amounts of mercuric ion, the effect of chloride ion on the separation, and the effect of simultaneous precipitation of copper sulfide with mercuric sulfide upon the amount of zinc which is postprecipitated. The order of the postprecipitation reaction has been studied.

The results of the postprecipitation experiments are summarized in the following sentences.

1. When the separation is made in 0.3 N HCl after a short exposure to hydrogen sulfide the amount of zinc sulfide which is found mixed with the mercuric sulfide is roughly a constant fraction of the amount of zinc originally present.

2. This fraction is determined by the rate of flow of the hydrogen sulfide and the time of exposure of the solution to the gas, other factors being held constant.

3. The amount of postprecipitation is reduced by an increase in the chloride ion concentration.

4. The amount of postprecipitation is reduced by an increase in the acidity of the solution.

5. The amount of postprecipitation is increased by an increase in the amount of mercuric sulfide.

6. The presence of cupric ion, which precipitates at the same time as the mercuric sulfide, decreases the amount of postprecipitation.

7. Mercuric sulfide precipitated by the hydrolysis of thioacetamide forms large crystals of mercuric sulfide and little or no postprecipitation of zinc is induced when this method of separation is employed.

8. The postprecipitation reaction seems to be a second order reaction, as shown in experiments in which the zinc is added just after the precipitation of the mercuric sulfide.

9. Mercuric sulfide seems to function as a catalyst, the rate of postprecipitation being a function of the amount of surface being formed. Thus, the rate of postprecipitation may be influenced by anything which changes the nature of the mercuric sulfide crystal which is formed.

For practical purposes the loss of zinc from solution in the Group II separation is usually less than twenty per cent in the semi micro scheme. By making the Group II separation by means of thioacetamide hydrolysis this loss can be practically eliminated.

Microfilm copy of complete manuscript of 122 pages, \$1.53. Enlargements 6" x 8", 10¢ per page.

#### THE SEPARATION OF CERIUM BY PRECIPITATION AS IODATE FROM HOMOGENEOUS SOLUTION

(Publication No. 3825)

Sylvia Shu Lien Tsai Yu, Ph.D.  
University of Michigan, 1951

When ceric iodate is precipitated from acid solution by the addition of a soluble iodate, a gelatinous precipitate is obtained. This precipitate is very voluminous and tends to carry down impurities by adsorption. It is difficult to filter and wash. The precipitate must be redissolved and reprecipitated as oxalate for final ignition as ceric oxide.

A method was devised to improve the nature of the ceric iodate by slow precipitation in homogeneous solution. Advantage is taken of the fact that cerium exists in two distinct valence states, the cerous and the ceric forms. Cerous iodate is soluble in dilute acid solution while ceric iodate is insoluble. Cerium is first reduced to the cerous state by hydrogen peroxide in nitric acid solution. Ammonium iodate is added and no precipitation occurs at this moment. The precipitation is brought about by the slow formation of ceric ion in the iodate solution by a suitable oxidizing agent, namely, ammonium persulfate, or sodium bromate. This is equivalent to adding the ceric ion one molecule at a time to the iodate solution. Thus a dense precipitate is formed slowly. This small volume of the precipitate greatly reduces adsorption. It also facilitates filtration and washing. The precipitate is ignited directly to ceric

oxide part of which is always stained with a brown color. This is remedied by evaporation of the ignited precipitate to dryness with a few drops of concentrated sulfuric acid and ignition to ceric oxide for final weighing.

For samples containing 10-50 mg of ceric oxide, a total volume of 300-400 ml gives best results. The optimum concentration of the nitric acid present is 0.4-0.5N. A starting temperature of 40-60°C favors the denseness of the precipitate. In the persulfate method precipitation takes place at elevated temperature (70-80°C) on a hot plate. In the bromate method the hot mixture is allowed to stand at room temperature to complete the precipitation process. Stirring not only improves the crystallinity of the precipitate and decreases the occlusion of impurities but also shortens the time for complete precipitation. Dilute iodic acid solution (1-2%) is used as wash solution. The method is good for samples containing 2.5-250mg of ceric oxide.

The composition of the precipitate is not reproducible. The precipitate is a basic iodate and the ratio of  $\text{IO}_3$  found /  $\text{IO}_3$  theoretical for  $\text{Ce}(\text{IO}_3)_4$  increases with the concentration of the nitric acid present to a maximum value of 0.910-0.920. The ratio never reaches unity. An analysis of the precipitate dried at 40-45°C for 2-3 days shows a fairly constant ratio of  $\text{IO}_3$  found /  $\text{IO}_3$  theoretical for  $\text{Ce}(\text{IO}_3)_4$ . From the ratio of  $\text{Ce}:\text{IO}_3$  an approximate formula  $\text{Ce}_2(\text{IO}_3)_7(\text{OH})\cdot\text{XH}_2\text{O}$  has been proposed for the precipitate obtained under the conditions described. "X" varies from 3-7 approximately.

Cerium can be successfully separated from the other rare earths, namely, neodymium, praseodymium, lanthanum, samarium, gadolinium, erbium and yttrium by this method. However, double precipitation is necessary for complete separation. If large amounts of the mixture of rare earths are present, the persulfate method is recommended. The bromate method tends to give high results.

Cerium can also be determined in the presence of magnesium, cobalt, chromic, nickel, and molybdate ions. Strontium, barium, bismuth, stannic, lead, silver, mercurous, mercuric, titanium, uranyl, manganese, ferric, zinc, cadmium, calcium, cupric, gallium, indium and thorium ions interfere and therefore should be removed prior to the determination.

Microfilm copy of complete manuscript of 90 pages, \$1.13. Enlargements 6" x 8", 10¢ per page.



## CHEMISTRY, PHARMACEUTICAL

THE PREPARATION OF LOCAL ANESTHETICS  
AND ANTISPASMODICS FROM BASIC  
ALCOHOLS WHICH CONTAIN 5-, 6-, 7- AND  
8-MEMBERED NITROGENOUS RINGS

(Publication No. 3783)

Chi-Jung Lu, Ph.D.  
University of Michigan, 1952

During this investigation the following five basic alcohols, derivatives of polymethylenimines, were prepared:

1. 1-Methyl-2-hydroxymethylpyrrolidine
2. 1-Methyl-2-hydroxymethylpiperidine
3. 1-(beta-Hydroxyethyl)-2-isopropyl-5-methyl-hexamethylenimine
4. 1-Methyl-2-hydroxymethylhexamethylenimine
5. 1-Methyl-2-hydroxymethylheptamethylenimine

Each alcoholic imine was obtained first in an unmethylated form; for reference the latter compounds are designated as 1', 2', 3', 4', and 5'.

Compound 1' was prepared by esterification of glutamic acid, cyclization of the diester to 2-carbethoxy-5-pyrrolidone, and reduction of the cyclic keto ester with lithium aluminum hydride (3-step synthesis).

In order to obtain compound 2', alpha-picoline was converted into alpha-picolinic acid hydrochloride and then into ethyl alpha-pipecolate; the latter substance was reduced with lithium aluminum hydride (4-step synthesis).

Menthol served as the initial material for the synthesis of compound 3'. It was oxidized to menthone which was converted into its oxime and the latter was rearranged with sulfuric acid to the lactam which, when hydrogenated with lithium aluminum hydride, yielded 2-isopropyl-5-methyl-hexamethylenimine. Treatment of the latter substance with ethylene chlorohydrin produced compound 3' (5-step synthesis).

The initial step in the synthesis of compound 4' consisted in the condensation of cyclohexanone with diethyl oxalate, and then elimination of carbon monoxide from the ethyl 2-ketocyclohexylglyoxylate to produce ethyl 2-ketocyclohexanecarboxylate. The latter compound was converted by sodium azide and sulfuric acid into the lactam 2-carbethoxy-7-keto-hexamethylenimine. The lactam was reduced to compound 4' by the use of lithium aluminum hydride (4-step synthesis).

The synthesis of compound 5' began with cyclohexanecarboxylic acid which was transformed into cyclohexylmethylamine either by the action of sodium hypobromite on cyclohexylacetamide or by the interaction of the acetic acid with sodium azide and sulfuric acid. Cyclohexylmethylamine, upon treatment with nitrous acid, yielded cycloheptanol which was oxidized to suberone (3- or 5-step synthesis). Suberone was allowed to react with ethyl oxalate, and carbon monoxide was eliminated from the glyoxalate which was formed to produce 2-carbethoxy-cycloheptanone. The latter substance reacted with

sodium azide and sulfuric acid to form the lactam 2-carbethoxy-8-ketoheptamethylenimine which was reduced with lithium aluminum hydride to compound 5' (the total synthesis required 7 or 9 steps).

The conversion of the unmethylated into N-methylated alcoholic polymethylenimines was accomplished by formylation with chloral and then reduction of the formyl compounds into the N-methyl derivatives by the use of lithium aluminum hydride.

Although chloral had been employed, in a few instances, many years ago as a formylation agent, its use for this purpose is practically unknown. It was found that this substance is an excellent general agent for N-formylation of a strong amine, and since N-formyl compounds can be reduced readily with lithium aluminum hydride, formylation followed by reduction represents a useful process for the synthesis of N-methyl derivatives in pure form.

It was shown that compounds, 1', 2' and 4', in the form of their hydrochlorides undergo Mannich reactions when heated with acetophenone and formaldehyde.

Hydrochlorides of p-aminobenzoates were prepared from compounds 1, 2, 3, 4 and 5. All of these compounds were found to be too irritant to mucous membranes to be of any practical value. Salts of diphenylacetates of compounds 1, 4 and 5, the benzilate and the beta-methyltropate of compound 1 were synthesized, and are to be tested for antispasmodic activity. Alcohols 1 and 4 were converted into their benzhydryl ethers; these products are to be examined for antihistamine activity.

Microfilm copy of complete manuscript of 122 pages, \$1.53. Enlargements 6" x 8", 10¢ per page.

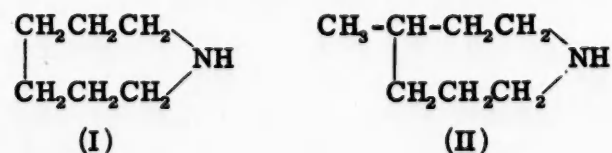
## ANTI-HISTAMINICS

(Publication No. 3809)

Gerald Robert Toy, Ph.D.  
University of Michigan, 1952

The majority of therapeutically useful compounds contain a basic substituent which is often a dimethyl- or a diethylamino group. It has been demonstrated that physiological activity is maintained when cyclic amino radicals, such as pyrrolidino or piperidino, are substituted for dialkylamino groups. It is felt, therefore, that the preparation for pharmacological study of compounds which contain seven-membered cyclic imino groups (that is, higher ring homologs of the piperidino radical) would be of interest.

Quantities of hexamethylenimine (I) and 4-methyl-hexamethylenimine (II) were synthesized, and from these cyclic bases the following compounds which are



structurally related to known antihistaminics were

prepared: four basic ethers, three ethylenediamine compounds, four 1,3-dioxalanes, two 1,3-dioxanes, and two basic ester.

Other new products which were prepared from these cyclic imines are: 1-formylhexamethylenimine, 1-(beta-phenylethyl)-hexamethylenimine, beta-hexamethyleniminoethyl phenyl ketone hydrochloride, beta-hexamethyleniminoethyl alcohol, the hydrochloride of beta-hexamethyleniminoethyl chloride, and the piperazinium compound which was obtained from the base of the last mentioned chloride hydrochloride. The 4-methylhexamethylenimino analogs of these compounds were also synthesized, and, in addition, 1-phenacylhexamethylenimine and 4-methylhexamethylenimine gamma-methylhexamethylene-dithiocarbamate were prepared.

In conjunction with previous work in this Laboratory on cyclic acetals and ketals, 2,2-diphenyl-4-aminomethyl-1,3-dioxalane hydrochloride and a group of three basically-substituted acyclic ketals were synthesized.

All of the basic compounds mentioned above were converted into one or more solid derivatives, such as hydrochlorides or quaternary ammonium salts.

The pharmacological action of these compounds is under investigation in another laboratory.

Microfilm copy of complete manuscript of 140 pages, \$1.75. Enlargements 6" x 8", 10¢ per page.

## ENGINEERING, AERONAUTICAL

### ON COMPRESSIBLE LAMINAR FLOW IN DUCTS

(Publication No. 3723)

James Eugene Broadwell, Ph.D.  
University of Michigan, 1952

This paper presents an analytical investigation of the steady two-dimensional motion of a viscous compressible gas between parallel straight walls. It is assumed that the flow is laminar and that the walls are insulated. Subsonic velocities only are considered.

The region of flow studied begins at a section far downstream from the channel inlet. In the region bounded by this initial section and the two walls the classical boundary layer equations are assumed to describe the motion. The problem, then, is to solve these equations subject to prescribed boundary and initial conditions. It may be mentioned that there is an important difference between the boundary layer problem and the one under consideration. In the former, the pressure distribution is assumed known from the external potential flow while in the channel problem the pressure is not known a priori.

It is shown that if the initial Mach number is sufficiently small then there is a region of flow in which the temperature variation may be neglected. In this

isothermal case the set of approximating equations is treated both by means of an iteration procedure and by use of a von Kármán momentum integral method. The results of the two procedures are in good agreement and consist primarily of expressions for the pressure gradient and for the change with distance along the channel of the velocity profile. It is found that there is a small out-flow from the center when the flow begins, at low Mach number, with conditions approximating those of fully-developed incompressible flow.

In another approach to the isothermal flow problem, the equation of motion is simplified further and takes the form of an unsteady heat conduction equation. The velocity profile variation indicated by a solution to this equation is compared, qualitatively, to those obtained by the methods mentioned above.

A modified momentum integral method is applied in the high speed non-isothermal flow region. The resulting non-linear ordinary differential equations describe the pressure distribution and velocity profile variation. This set of equations is not solved but solution by use of an analog computer appears feasible. An approximate expression for the pressure distribution is obtained.

There is evidence that the approximate equations considered throughout the analysis become invalid as the region of sonic velocity is approached.

Microfilm copy of complete manuscript of 64 pages, \$1.00. Enlargements 6" x 8", 10¢ per page.

### A STRUCTURAL THEORY INCORPORATING THE EFFECT OF TIME-DEPENDENT ELASTICITY

(Publication No. 3726)

Maurice Andre Brull, Ph.D.  
University of Michigan, 1952

The purpose of this study is to develop a structural theory in which the effects of time-dependent elasticity are considered. The need for this investigation arises from the fact that certain structures are at present being designed to operate at elevated temperatures, where the elastic properties of materials become time-dependent. Examples of such structures are the airframes of high-speed aircraft and internal parts of jet engines. In order to analyze these structures correctly and to prescribe suitable structural tests, it becomes necessary to devise a method to predict stresses and deflections and, in particular, to determine the permanent deformations which will occur under load.

In Chapter I, a stress-strain relation is selected on the basis of theoretical and experimental results obtained by other authors. The overall material properties are represented in one dimension by the use of linear mechanical models. It is pointed out that material properties can be suitably represented to the desired accuracy by the choice of the model elements.



In Chapter II, the linear model stress-strain relation is generalized in the same way as the generalized Hooke's Law is deduced from the one-dimensional Hooke's Law in conventional elasticity. The general equations of time-dependent elasticity are then developed on the basis of this new equation of state. The form of these equations is such that two theorems can be stated, which permit direct modification of conventional elasticity solutions to account for the effects of time-dependent elasticity. The modification is carried out as follows: (1) The Laplace transform with respect to time of the elasticity solution is obtained; (2) This Laplace transform is modified by replacing various elastic constants by functions of the argument of the transformation (this amounts to making the elastic properties time-dependent); (3) The time-dependent elasticity solution is then found by carrying out the inverse Laplace transformation on the expression obtained by steps (1) and (2).

This method is used in Chapters III and IV when solutions to various statical and dynamical problems are obtained.

The lateral deflection of beams and plates and the bending of continuous beams are studied in Chapter III. It is found that the elastic solutions for deflections are simply multiplied by certain functions of time. Solutions for the longitudinal and lateral vibrations of beams are presented in Chapter IV. The study of the free and forced vibrations of cantilever beams shows the occurrence of permanent deformation.

The principal conclusions which can be drawn from this investigation are:

- (1) Solutions of time-dependent elasticity problems can be obtained directly from the corresponding solutions of the conventional theory of elasticity by using the procedure outlined above. Furthermore, the method developed can easily be applied to other fields than that of time-dependent elasticity, since it is a general procedure which takes into account any linear memory effect.
- (2) Within the range of application of the present theory, stress concentration factors are unaffected by the time dependent elastic properties and deviations from this behavior can be attributed to non-linearity of the material properties.
- (3) Time-dependent elastic properties introduce damping in the solutions to dynamical problems and also give rise to substantial permanent deformations.
- (4) With the existence of a theory of time-dependent elasticity outlined in the study, this field becomes open for experimental investigations.

Microfilm copy of complete manuscript of 82 pages, \$1.03. Enlargements 6" x 8", 10¢ per page.

## A SHOCK TUBE INVESTIGATION OF DETONATIVE COMBUSTION

(Publication No. 3786)

Richard Boyd Morrison, Ph.D.  
University of Michigan, 1952

The detonation of gaseous inflammable mixtures is precipitated in a shock tube by means of shock waves. The experimental detonation velocities associated with these waves are measured for oxygen mixtures of a paraffin series of fuels viz. methane, ethane, propane, butane, and hexane. Also oxygen mixtures of hydrogen, diethyl ether, and acetylene and air mixtures of hydrogen were tested. All these experimental detonation velocities are correlated by means of two dimensionless relations, one a heating parameter and the other the Mach number of detonation.

The existing theory of detonative combustion is briefly reviewed and discussed. The theory is analytically extended to obtain direct functional relations between the dynamic properties and the thermodynamic properties of detonating mixtures. From these analyses the parameters which correlated the detonation velocities are indicated. The close connection between shock waves and detonation waves is discussed, and it is observed that the normal shock may be regarded as the degenerate case of a strong detonation with no heat addition.

The unsteady flow problem associated with shock tubes is treated for conditions wherein detonations as well as shocks are produced in the tube. The results of these analyses are graphed in a form that makes a rapid solution of many unsteady flow problems possible. The shapes of pressure waves in the wake of detonations are examined theoretically.

Spark schlieren photographs taken of detonation waves at exposure times much less than a microsecond in duration indicate the existence of flow instabilities for the case of lean detonating mixtures.

The experimental equipment used to produce and study detonative combustion is described. Timing equipment capable of recording times under one-hundred microseconds and the apparatus used for calibration of this timer is discussed. Special ionization probes for sensing the presence of the detonation and miscellaneous electronic equipment is also described.

Microfilm copy of complete manuscript of 149 pages, \$1.86. Enlargements 6" x 8", 10¢ per page.

## SOME EFFECTS OF SURFACE CURVATURE ON LAMINAR BOUNDARY-LAYER FLOW

(Publication No. 3787)

James Sidney Murphy, Ph.D.  
University of Michigan, 1952

The laminar flow of a viscous, incompressible fluid over a two-dimensional curved surface is

investigated for two cases, one in which the curvature of the surface is "moderate" and the other in which it is "large." The boundary-layer equations applicable to these cases are obtained as approximations from the exact equations of motion by an order-of-magnitude analysis. These equations are solved for flow over a particular surface with zero surface pressure gradient. In this analysis, the pressure gradient normal to the surface is included and the outer boundary conditions are modified in accordance with the requirements of flow over a curved surface.

The results indicate that the effects of moderate surface curvature, aside from surface pressure gradient, on the wall stress are small. The trend is such that for equal Reynolds' numbers, the stress on convex surfaces is less than the flat-plate value, while the stress on concave surfaces is greater than that for a flat plate. For flow over a surface with large convex curvature, the results indicate that the wall stress is less than that for moderate convex curvature.

The most important effect of surface curvature for the cases considered is the modification of the shape of the velocity profile near the "outer edge" of the boundary layer. The requirement that a smooth transition exist between the viscous flow and the potential flow at the "outer edge" of the layer causes the profile to have a negative slope near the outer edge for convex surface curvature and a positive slope for concave surface curvature.

Qualitative analysis of the equations of motion for the general problem of two-dimensional flow over moderately curved surfaces shows that the normal pressure gradient can influence the location of the point of separation. In particular, when the surface curvature varies in such a manner that  $\partial K/\partial x < 0$  and is large, a tendency toward separation will exist.

In conclusion, an approach is presented for the complete solution of a general problem for moderate surface curvature, including both surface and normal pressure gradients and the modified outer boundary conditions. This solution can be completed by numerical integration of a set of ordinary fourth-order differential equations, one of which is nonlinear.

Microfilm copy of complete manuscript of 62 pages, \$1.00. Enlargements 6" x 8", 10¢ per page.

#### SOME SPECIAL PROBLEMS IN THE STABILITY OF LAMINAR FLOWS

(Publication No. 3801)

John Randolph Sellars, Ph.D.  
University of Michigan, 1952

The method of small perturbations is employed to discuss the stability of several special cases of laminar flows. Analytical methods are employed to solve the equations as well as direct computations on an electronic differential analyzer.

Viscous, incompressible, parallel, flow is found to be completely stable to small perturbations which only involve velocities which are perpendicular to the main direction of flow. This fact is established for both axially symmetric flows and for two-dimensional cases and is independent of the exact shape of the velocity profile of the main stream.

Perfect fluid Couette flow (plane) and perfect fluid Poiseuille flow in pipes are found to be completely stable. The method of solution involves resolving the disturbance into Fourier components in the direction of the main flow and then solving the resulting partial differential equation in the time and the other coordinate for each Fourier component.

The work which has been done previously by Sexl and Pretsch for axially symmetric flows is reviewed critically and it is concluded that Pretsch's work is incorrect.

The solution of stability problems on a differential analyzer is discussed and a special type of disturbance is considered in detail. This disturbance varies as  $e^{-\alpha x}$  where  $\alpha$  is a real number, rather than as  $e^{i\alpha x}$ , as in the Orr-Sommerfeld equation. The resulting eigenvalue equation is found to be simple to solve on the differential analyzer, and neutral curves are drawn for the two velocity profiles. It is concluded, however, that this disturbance is not sufficiently close to the physical realities to be significant as a criterion of stability.

Eigenvalues for the Orr-Sommerfeld equation are found for two velocity profiles for  $\alpha = 0$ . The eigenvalues for Poiseuille flow are compared to the results of Pekeris for  $\alpha = 0$  and there is no agreement. It is postulated that Pekeris has an error in his calculations, although there is a slight possibility that Pekeris was considering another mode.

Microfilm copy of complete manuscript of 86 pages, \$1.08. Enlargements 6" x 8", 10¢ per page.

#### ENGINEERING, CHEMICAL

##### RATES OF ALCOHOLYSIS AND DIFFUSION IN ION-EXCHANGE RESINS

(Publication No. 3713)

George Edward Barker, Ph.D.  
University of Michigan, 1952

The purpose of this investigation was to determine, measure, and correlate the factors contributing to the overall reaction rates of a typical alcoholysis reaction conducted with a cation-exchange resin as a catalyst. The reaction studied was the alcoholysis of n-butyl acetate by ethanol with a nuclear sulfonic acid resin (Dowex 50) as the catalyst.

Reaction-rate data were obtained under steady-state conditions by passing the liquid feed through a fixed-bed of resin particles. Product mixtures were analyzed by an empirical infra-red spectrophotometric



method. The range of variables studied was: temperature, 50-80°C.; resin bead size, 20-115 Tyler mesh; feed composition, 0.5-4.0 mole ratio ethanol to butyl acetate; butyl acetate conversion, 10-55%.

Diffusivities of all four components in the resin phase were measured by a method based on the swelling-rate of a single resin particle when immersed in the pure liquid. A microscope was used to measure the particle diameter. All swelling-rate measurements were conducted at room temperature using spherical particles from 0.02-0.08 cm. in diameter. The percentage resin cross-linkage was varied from 1-8 %.

Reaction-rate data were correlated by the solution to a differential equation describing diffusion and reaction within the resin. Liquid-phase mass-transfer resistance was found to be absent. The data were correlated by the differential rate expression:

$$F_v d[\text{EtAc}] = \frac{k_s \phi}{625} \times \frac{[\text{EtOH}][\text{BuAc}] - [\text{EtAc}][\text{BuOH}]}{0.170 [\text{EtOH}] + [\text{BuOH}]} \times dW$$

$F_v$  is the feed rate in liters/hour

$W$  is the weight of resin (oven-dry) in grams

$k_s$  is the specific reaction velocity constant in the resin, a function of temperature alone

$\phi$  is a volumetric efficiency function for the resin beads. It is the ratio of the average rate of reaction in the resin beads to the reaction rate at the resin surface.

The reaction rate at the resin surface and diffusional resistance within the resin beads (embodied in  $\phi$ ) control the reaction velocity.  $k_s$  was related to temperature by:

$$\log_{10} k_s = 8.01 - 2630/T \quad (T \text{ in } ^\circ\text{Kelvin})$$

A knowledge of the efficiency function,  $\phi$ , permits computation of resin-phase diffusivities of all four components if the ratios of the various diffusivities to one component are known. These diffusivity ratios were computed by the solution to a partial differential equation using the results from the swelling-rate measurements. Diffusivities determined from swelling-rate measurements were:

Component	Diffusivity, cm <sup>2</sup> /hr, at 20°C.
Ethanol	$8.90 \times 10^{-4}$
Butyl Acetate	$0.52 \times 10^{-4}$
Butanol	$5.30 \times 10^{-4}$
Ethyl Acetate	$0.28 \times 10^{-4}$

Resin-phase diffusivity of ethanol was related to temperature by:

$$\log_{10} D = 4.29 - 2150/T$$

derived from reaction-rate data. Diffusivities determined by the two methods are in good agreement. Results of experiments with low-cross-linkage resin showed that the ethanol diffusivity was doubled by reducing cross-linkage from 8 to 1%. Phase relations of the resin were also affected, so that overall reaction rates were increased 520% by this change.

The method of reaction-rate correlation by the differential equation describing diffusion and reac-

tion within the resin has been verified. A new method of predicting resin-phase diffusivities by measuring resin swelling rates has been developed and verified. It is concluded that cation-exchange resin is an efficient and convenient catalyst for alcoholysis reactions. Results of this study indicate that use of low-cross-linkage resin will be beneficial in alcoholysis reactions involving larger molecules with low diffusivities and low solubilities in the resins.

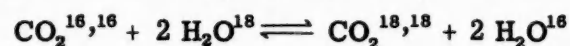
Microfilm copy of complete manuscript of 147 pages, \$1.84. Enlargements 6" x 8", 10¢ per page.

## THE CONCENTRATION OF OXYGEN EIGHTEEN BY CHEMICAL EXCHANGE

(Publication No. 3721)

Worthy Truman Boyd, Ph.D.  
University of Michigan, 1951

The purpose of this investigation was the development of the carbon dioxide-water chemical exchange process for the concentration of oxygen of mass eighteen. The exchange reaction may be written,



A column was constructed which supplied data on the effect of temperature, pressure, and ammonia concentration on the height of column equivalent to a theoretical stage. These data may be used in the design of a production unit.

The apparatus consisted of a 70 foot column constructed of one inch steel pipe filled with small wire helices. Carbon dioxide from commercial cylinders was fed to the bottom of the column. At the top of the column the carbon dioxide was reduced to water and methane over a nickel catalyst. The water flowed down the column countercurrent to the carbon dioxide. The oxygen of mass eighteen concentrated at the top of the column.

Ammonia was added to the reflux water in concentration up to 4.5 grams per 100 grams of solution flowing down the column. The column was operated at pressures from 90 to 240 pounds per square inch and at temperatures from 17° to 122° Centigrade. Two different types of packing were investigated.

The separation factor and height of column equivalent to a theoretical stage or reactor unit were determined from the data by means of equations which were developed. The separation factor was somewhat lower than predicted theoretically and varied from 1.014 at 122°C. to 1.028 at 50°C. The height of column equivalent to a theoretical stage (H.E.T.P. or H.R.U.) varied from 60 feet to 0.54 feet under different conditions of temperature, pressure, and ammonia concentration. The reaction rate was the controlling factor in the column.

The H.E.T.P. was approximately proportional to pressure at 20°C. Ammonia addition decreased the H.E.T.P. by about 50 percent.

The optimum operating conditions for a commercial unit are 140°C. and 400 psi with ammonia.

Without ammonia the temperature should be 160°C.

The cost of producing 21 percent oxygen eighteen by chemical exchange is about \$18 per gram at 10,000 grams per year and \$45 per gram by thermal diffusion. Both processes will produce 400 grams per year at an equal cost of \$60 per gram. At lower production rates the thermal diffusion process is favored.

Microfilm copy of complete manuscript of 161 pages, \$2.01. Enlargements 6" x 8", 10¢ per page.

**ELECTROCHEMISTRY OF SYSTEMS  
CONTAINING ALUMINUM PHOSPHATE  
DISSOLVED IN FUSED BORATE  
AND PHOSPHATE MIXTURES**

(Publication No. 3704)

Tsei-Yu Chao, Ph.D.  
Virginia Polytechnic Institute, 1952

The purpose of this investigation was to study the possibility of using, as electrolyte for the deposition of aluminum, systems containing aluminum phosphate dissolved in fused borate and phosphate mixtures.

Aluminum coated metals combine the mechanical properties of the base metal and chemical resistance of aluminum. Electroplating, gives an even and controlled thickness of coating and imparts corrosion resistance.

Methods for the deposition of aluminum previously investigated have not been used commercially, to any extent. Electrodeposition of aluminum was attempted, most frequently from nonaqueous organic solutions and from fused mixtures. Aluminum halides, especially aluminum chloride, was the solutes most frequently used. It is known that aluminum oxide is peptized by aluminum chloride. Severe corrosion is expected on articles electroplated in the presence of aluminum chloride.

In the present investigation, the use of aluminum halides was avoided. Aluminum phosphate was employed in the system  $5\text{Na}_2\text{O} \cdot 10\text{Li}_2\text{O} \cdot 6\text{B}_2\text{O}_3$  as well as in the eutectic mixture of sodium metaphosphate and sodium pyrophosphate. In none of the investigations was an electrodeposit of aluminum obtained.

Investigation of the borates-phosphate mixtures comprised determination of a "fluid range"-composition diagram of the sodium oxide-lithium oxide-boric oxide system. The "fluid range" is a temperature range from an upper value at which, on cooling, liquid becomes viscous, to a lower value at which the solid first appears. These data were plotted on composition diagram which appears as a limiting composition curve and two isothermal, fluid range-composition curves at 600 and at 660°C. The limiting composition is expressed as the minimum content of the boric oxide which will eliminate all carbon dioxide from the boric acid and alkali carbonates mixture. The area encircled between the 660°C, upper fluid range and the limiting composition curve is a composition region in which electrodeposition of solid aluminum may be possible.

In this region, a mixture of the composition  $5\text{Na}_2\text{O} \cdot 10\text{Li}_2\text{O} \cdot 6\text{B}_2\text{O}_3$  was taken as the solvent for the aluminum phosphate, and the fluid range-composition curve of this mixture was determined. It was found that the addition of aluminum phosphate to the molten  $5\text{Na}_2\text{O} \cdot 10\text{Li}_2\text{O} \cdot 6\text{B}_2\text{O}_3$  has little effect on the fluid range up to 18.68 per cent by weight of aluminum phosphate.

Because the fused electrolyte is very corrosive, its action on different containers was studied. These containers included those made of porcelain, nickel, ampcop metal, armco iron, plumbago, graphite and platinum. Except for the graphite and the platinum, no material was suitable for use as a container.

No aluminum was electrodeposited from the molten bath of  $5\text{Na}_2\text{O} \cdot 10\text{Li}_2\text{O} \cdot 6\text{B}_2\text{O}_3$  or from its solution with aluminum phosphate. Both aluminum anode and platinum cathode were covered with black deposits after electrolysis.

The deposits were studied by chemical methods, spectrographical analysis and X-ray analysis. Final results showed that they consisted primarily of carbon. A search for the source of this carbon, formed in the electrodeposition, indicated that it came from the carbon dioxide absorbed from the air by the fused electrolyte. A mechanism for the reaction was proposed.

Electrochemical properties of the electrolyte  $5\text{Na}_2\text{O} \cdot 10\text{Li}_2\text{O} \cdot 6\text{B}_2\text{O}_3$  as well as those of its solution with aluminum phosphate were studied. Both the molten  $5\text{Na}_2\text{O} \cdot 10\text{Li}_2\text{O} \cdot 6\text{B}_2\text{O}_3$  and the molten mixture of 9.4 per cent of aluminum phosphate and 90.6 per cent of  $5\text{Na}_2\text{O} \cdot 10\text{Li}_2\text{O} \cdot 6\text{B}_2\text{O}_3$  showed no decomposition potential on electrolyzing with aluminum anode and platinum cathode. If platinum electrodes were used for borates-phosphate system, the current was constant when stirred, when moisture was added, and when the electrodes were immersed periodically. The decomposition potential determined for the borates-phosphate system with platinum electrodes was about 1.40 volts, at  $600 \pm 10^\circ\text{C}$ . Qualitative electrodeposition tests showed that no aluminum could be deposited from either electrolyte. Quantitative electrodeposition test with the molten  $5\text{Na}_2\text{O} \cdot 10\text{Li}_2\text{O} \cdot 6\text{B}_2\text{O}_3$  showed that the weight loss of the aluminum anode consisted of both electrolytic loss and direct chemical attack.

Also, a eutectic mixture of the sodium metaphosphate and sodium pyrophosphate was used as the solvent to dissolve aluminum phosphate for electrolysis. The molten mixture had a strong oxidizing power, the aluminum anode became passive, and a strong anode effect was observed, if an aluminum anode was used. Black coatings were formed on the copper cathode with either an aluminum anode, or an anode of an alloy of 75 per cent of aluminum and 25 per cent of copper, or a platinum anode. The black coating on the copper cathode was found by chemical analysis to be a copper compound.

Microfilm copy of complete manuscript of 294 pages, \$3.68. Enlargements 6" x 8", 10¢ per page.



## SURFACE VARIABLES IN BOILING

(Publication No. 3739)

Claude Corty, Ph.D.  
University of Michigan, 1952

Variables, such as surface roughness and contact angles, at the solid-liquid interface during boiling were studied by obtaining heat transfer data on diethyl ether, n-pentane, and Freon 113 boiling from copper and nickel surfaces polished with #0000 emery polishing paper, and n-pentane boiling from nickel surfaces polished with Nos. 00, 0, 1, and 3 emery polishing paper.

The apparatus consisted of a horizontal heated surface, rectangular and 3 sq. in. in area, submerged 1-1/2" below the level of a pool of the boiling liquid. Heat input was electrical, and surface temperatures were determined from thermocouples placed inside the heater block.

Heat transfer data was obtained, and boiling bubbles were photographed to supply contact angle and bubble size information. Surface roughnesses were determined with a Profilometer, and photomicrographs and electronmicrographs of the surfaces were made. The active centers during boiling were counted when such counting was feasible, and visual observations of the boiling process were made.

The principal conclusions reached during the investigation were as follows: The micro-roughness of the surface (2-23 micro-inches root-mean-square, as measured with the Profilometer) is a major variable in boiling. Changes in roughness change the superheat necessary to cause bubbling, with the smoothest surfaces requiring the greatest degree of superheating. The contact angle is a second major variable acting at the boiling surface.

The mechanism of normal nucleate boiling seems to be one in which a bubble, when breaking loose, leaves a residue of vapor in a surface cavity; this residue acts as nucleus for the next bubble from that cavity. The shapes and sizes of surface cavities (sizes which are on the order of magnitude of ten microinches) as well as the contact angles, determine the radii of curvature of the nucleus bubbles and hence the superheat necessary to make them viable. The size distribution of cavities in the surface determines the change in heat necessary to alter the number of active centers sufficiently to accommodate a new heat flux. Hence a wide size distribution of cavities results in flat slopes of the boiling curve; a narrow size distribution, due to regular surfaces, results in steep boiling curves.

A hysteresis effect in boiling was observed. This effect seems actuated by the different superheats necessary to sustain bubbling from vapor residues, on one hand, and, on the other hand, to initiate and to spread bubbling where no bubbling existed.

Based on the observations and on the proposed mechanisms, it has been possible to explain the effect on the position of the boiling curve of surface roughness, contact angle, formation of adherent and nonadherent scale, presence of gases, and changes in pressure.

Microfilm copy of complete manuscript of 261 pages, \$3.26. Enlargements 6" x 8", 10¢ per page.

A STUDY OF THE FORMATION  
OF GAS BUBBLES FROM HORIZONTAL  
CIRCULAR SUBMERGED ORIFICES

(Publication No. 3678)

Leon Davidson, Ph.D.  
Columbia University, 1951

This paper deals with gas bubbles formed in a body of liquid by supplying gas from an external source through a single orifice or tube. The chief variables were considered to be the orifice size, gas flow rate, and gas volume below the orifice. Container size and liquid depth were found to be not important. For constant conditions, at very low flow rates, the bubble volume remained constant and bubble frequency increased proportionately to the gas flow rate. At higher flow rates the bubble frequency became approximately constant and the bubble volume increased proportionately to the gas flow rate. In the transition region the bubble frequency sometimes changed erratically between definite limits.

Qualitative descriptions of bubble behavior are given, based on stroboscopic observations made during about six hundred and sixty runs under different conditions of orifice size, gas flow rate, etc. The phenomena are illustrated by over fifty speed-flash photographs of various typical stages of bubble formation. Quantitative results of the runs are presented in forty-two plots of experimental data relating bubble frequency and bubble volume to the gas flow rate through twenty different orifices. Typical curves have also been drawn showing the features usually to be found in the curves of bubble frequency or volume vs. flow rate.

The process of bubble formation is analyzed from the theoretical viewpoint and various expressions are developed for bubble size, limiting orifice size, etc. The effect of the volume of the gas space below the orifice is treated theoretically and experimentally. It is shown that increasing the volume of gas space below the orifice will increase the volume of the bubble formed.

The importance of a gas supply system having extremely constant pressure is pointed out, and the technique of counting bubbles stroboscopically is explained. The reproducibility of data from different orifices of the same size is shown in detail on several plots. The effects of liquid viscosity, and of circulation of liquid past the orifice, are discussed from the viewpoint of the literature and also from the experimental and theoretical viewpoint.

Critical discussions of the literature on the subject are included. A correlation of the literature data is given, which shows that the square root of the orifice radius is an important correlating function.

Among the phenomena observed experimentally, which have not apparently been previously described in the literature, are the grouping of rising bubbles into pairs, and the coalescence of members of a pair of bubbles into one large bubble. Details are given of the transition, as gas flow rate increases,

from single bubbles forming with equal volumes to the "chain" of bubbles forming with "constant" frequency.

The twenty orifices used had inside radii varying from 0.017 cm. to 0.79 cm. Air was the only gas used, and water was the liquid used for most of the work, although two grades of mineral oil were used in a few runs. A general discussion is given of the effects of liquid and gas properties.

The experimental results are correlated by a linear arithmetic plot of maximum bubble frequency vs. the reciprocal of the square root of orifice radius, and by a logarithmic plot of bubble volume vs. (gas flow rate times square root of orifice radius). A possible dimensionless plot is discussed.

Microfilm copy of complete manuscript of 221 pages, \$2.76. Enlargements 6" x 8", 10¢ per page.

## TWO-PHASE AND THREE-PHASE EQUILIBRIA IN THE SYSTEM: CARBON DIOXIDE-METHANE

(Publication No. 3741)

Harold George Donnelly, Ph.D.  
University of Michigan, 1952

An experimental investigation of the characteristics of the binary equilibrium system of methane and carbon dioxide was made. In the course of the investigation, experimental data were obtained of four differing natures, each intended to define a specific portion of the system, or to limit the regions otherwise defined.

The following portions of the system were investigated: the critical locus; the di-variant liquid-vapor equilibria to minus 100 degrees Fahrenheit; a large portion of the liquidus surface in which the solutions were saturated with solid carbon dioxide; and a considerable portion of the three-phase locus describing the equilibria in which solid carbon dioxide is in co-existence with the liquid and vapor phases.

To adequately define the upper temperature boundary, the critical temperature and pressure of four mixtures were determined; 0.12, 0.295, 0.457, and 0.82 mol fractions of methane. These conditions show the maximum pressure for coexistence of liquid and vapor phases is 1250 pounds per square inch absolute, while the critical temperatures progress regularly from 88 to minus 116 degrees Fahrenheit with increasing methane contents.

The liquid-vapor equilibria from the critical locus to the inception of the solid state was determined through investigation of seven isotherms: 29, 8, minus 25, minus 57, minus 65, minus 83, and minus 100 degrees Fahrenheit. Cross-plots of the isothermal data are presented as isobaric, temperature-composition sections of the system.

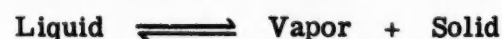
Studies in the two-phase fluid region were made by the closed-circulation method in which the vapor phase was re-cycled by an externally-situated, magnetic pump until the phase came to thermal and mass

equilibrium with the liquid. Samples of the co-existing phases were obtained while maintaining equilibrium conditions, and analysis of the phases was made by absorption of the carbon dioxide in caustic potash solution.

Studies of the critical conditions were made in a rocking-type, glass-windowed gage, permitting visual observation of the relative quantities of the liquid and vapor phases as a function of the pressure at several constant temperatures. The same equipment was suitable for the measurement of conditions for formation of the solid phase from carbon dioxide-rich liquids, and for the co-existence of the three phases: liquid, solid, and vapor.

The data are presented for the liquidus curve of the carbon dioxide saturated liquids as the temperature for solid inception for four mixtures: 0.132, 0.232, 0.574, and 0.795 mol fractions of methane.

Twenty temperature-pressure co-ordinates for the coexistence of three phases in the mono-variant equilibrium were determined to establish the three-



phase curve for this equilibrium. The range investigated covers the maximum pressure for the existence of these three phases and establishes the positive slope portion of the curves. In conjunction with the liquid-vapor phase data and the liquidus curve data, the compositions of the three-phase-vapor and the three-phase-liquid phases are presented as a function of pressure.

Isolation of the solid phase from this three-phase equilibrium, and observation of its melting temperature indicated the solid was practically pure carbon dioxide.

The several experimental studies have been fitted together to show the compatibility of the data; and the methane-carbon dioxide system is adequately defined from the critical locus to minus 109 degrees Fahrenheit, which includes some portions of the solid-liquid and solid-vapor equilibria regions.

Microfilm copy of complete manuscript of 290 pages, \$3.63. Enlargements 6" x 8", 10¢ per page.

## THE SYNTHESIS OF METHANE BY THE HYDROGENATION OF CARBON MONOXIDE IN A TUBULAR REACTOR

(Publication No. 3752)

Murray Mack Gilkeson, Jr., Ph.D.  
University of Michigan, 1952

An investigation was made of the catalyzed reaction between carbon monoxide and hydrogen in a type 303 stainless steel reactor in which the cylindrical surface served as the catalyst. End effects were eliminated by shielding the reactor wall, exclusive of the catalytic surface, with ceramic tubing.

The equipment consisted of a gas supply unit, a flow control unit, and a reactor unit. The hydrogen



and carbon monoxide feed gases passed separately from the gas supply unit at a regulated pressure to the flow control unit where each flow rate was individually controlled under conditions of constant temperature and pressure. The gas was then led to the top of the reactor where the feed streams were joined. A single product line was passed back to the control unit where the stream pressure was reduced to essentially atmospheric pressure for flow rate measurement and venting.

The effects of variations in feed composition and flow rate were studied over the temperature range of 900° F. to 1500° F. at pressures of ten, twenty and thirty atmospheres.

It was concluded that catalyst activity was essentially independent of time although pitting, slight carbon deposition (in a partially ordered arrangement), and sub-surface carbide penetration were observed. Catalyst activity was found to be a function of the method of pretreatment. The type of pretreatment affected both the magnitude and temperature range of catalyst activity.

The slowest (rate controlling) process in the tubular reactor was a catalyzed surface reaction whose rate rose from near zero at 900° F. to a maximum at 1000° F. and then fell gradually as the temperature was raised further. A monotonic increase in rate with an increase in pressure was observed. The best general correlation of the rate of methane formation ( $U$ ) as a function of partial pressure ( $p$ ) was given by the equation,

$$U_{\text{CH}_4} = \frac{(p_{\text{CO}} p_{\text{H}_2}^2 - K^{-1} p_{\text{CH}_4} p_{\text{H}_2\text{O}} p_{\text{H}_2}^{-1})}{(A + B p_{\text{CO}} + C p_{\text{CH}_4} + D p_{\text{CO}_2} + E p)^3}$$

Variation of the feed constituents showed that the water-gas-shift reaction and the hydrogenation of carbon dioxide were also catalyzed by the catalyst studied. However, the reaction decomposing carbon monoxide to carbon and the homogeneous gas-phase reaction of carbon monoxide and hydrogen were found to occur at negligible rates.

Synthetic natural gas of 540-Btu value (per cubic foot) was producible on the untreated catalyst. A nitriding pretreatment yielded gas of 700-Btu value.

Microfilm copy of complete manuscript of 183 pages, \$2.29. Enlargements 6" x 8", 10¢ per page.

#### THE EFFECT OF ULTRASONIC IRRADIATION ON THE SPECIFIC REACTION RATE CONSTANT IN THE ACID HYDROLYSIS OF ETHYL ACETATE

(Publication No. 3705)

Walter Clarke Gray, Ph.D.  
Virginia Polytechnic Institute, 1952

The speed of a chemical reaction is important in determining the efficiency of many industrial

chemical reactions. In organic reactions particularly, when there is the possibility of several reactions going on simultaneously, that reaction which is fastest is the one that predominates and often affects the economics of the process.

The object of this investigation was to determine the effect of ultrasonic irradiation on the specific reaction rate of the hydrolysis of an aqueous solution of ethyl acetate in the presence of hydrochloric acid as the catalyst.

The commercially obtained ultrasonic generator was limited to four frequencies — namely, 400, 700, 1000, and 1500 kilocycles. Two thousand volts plate voltage could be applied to the quartz crystal plates provided the plate current did not exceed 360 milliamperes.

A special pyrex glass reactor was designed and constructed in order that isothermal conditions could be maintained within the boundary of the reactor. The period of time the reaction mixture was subjected to ultrasonic irradiation was arbitrarily set at 10 minutes for a given power and frequency at  $19 \pm 0.1^\circ \text{C}$  and  $30 \pm 0.1^\circ \text{C}$  respectively. The tests were then repeated using a 20 minute period of irradiation. Individual mixtures were respectively irradiated at 0, 500, 1000, and 1500 volts plate voltage.

The composition and volume of the mixture irradiated was 100 ml of 1.9904 N hydrochloric acid, 90 ml of distilled water free from carbon dioxide, and 10 ml of ethyl acetate making a total volume of 200 ml.

The chemical reaction assumed for the investigation was



The course of the reaction was followed in such a way that the concentrations of the reacting substances were not disturbed. Samples of the mixture were drawn off at intervals and titrated with sodium hydroxide using phenolphthalein as the indicator.

Calculations were based on the difference of the titration at any time  $t$  in minutes and the titration at the end of 24 hours. When the reaction was completed, this difference was a measure of the concentration of ethyl acetate remaining unchanged or unhydrolyzed at time  $t$ . Each molecule of ethyl acetate that hydrolyzed produced one molecule of acetic acid, and the increase in acidity was a direct measure of the amount of ethyl acetate that had reacted. The amount of hydrochloric acid remained unchanged throughout the experiment.

The concentrations of ethyl acetate calculated from the differences between the titration values and the final titration were arranged in tabular form. A graph was drawn on semilogarithmic paper by plotting the concentration of ethyl acetate,  $c$ , against time,  $t$ , in minutes and the best straight line drawn through the points.

Using the equation,

$$-\log c_A = \left(\frac{k}{2.303}\right) t + \text{constant},$$

the specific reaction rate,  $k$ , was calculated by multiplying the slope of the line by 2.303.

The activation energy,  $E$ , was calculated from the values of  $k$  at  $19 \pm 0.1^\circ\text{C}$  and  $30 \pm 0.1^\circ\text{C}$  using the equation,

$$E = \frac{2.303 \log_{10} k_2/k \times R \times T_1 \times T_2}{T_2 - T_1}$$

where  $k_1$  = specific reaction rate at  $19 \pm 0.1^\circ\text{C}$   
 $k_2$  = specific reaction rate at  $30 \pm 0.1^\circ\text{C}$   
 $R$  = constant  
 $T_1$  = Absolute temperature for  $19 \pm 0.1^\circ\text{C}$   
 $T_2$  = Absolute temperature for  $30 \pm 0.1^\circ\text{C}$

The results of this investigation showed that the specific reaction rates were increased by ultrasonic irradiation of 400, 700, 1000, and 1500 kc in the order of five percent for 20 minute irradiation over the rates for 10 minute irradiation.

Microfilm copy of complete manuscript of 531 pages, \$6.64. Enlargements 6" x 8", 10¢ per page.

#### THE EFFECT OF SOME IONIC CRYSTALS IN NUCLEATING QUIET SUPERSATURATED POTASSIUM CHLORIDE SOLUTIONS

(Publication No. 3791)

George William Preckshot, Ph.D.  
University of Michigan, 1951

The purpose of this work has been to determine the effect of crystallographically similar, insoluble, ionic crystals, namely lead selenide, lead telluride, stannous telluride, and naturally occurring lead sulfide in nucleating quiet solutions of potassium chloride referred to the spontaneous nucleation of these same solutions. These potassium chloride solutions were saturated at  $49.453^\circ\text{C}$ . and the examination was made over a  $10^\circ$  range of subcooling from  $42$  to  $32^\circ\text{C}$ .

A conductometric instrument was devised to detect nucleus formation in quiet aqueous salt solutions. Changes in concentration as small as .16 ppm. were detectable.

The nucleation of these solutions was found to depend on the crystalline solid present. Potassium chloride nuclei formed on lead selenide crystals for subcoolings of  $7.4$  to  $17.2^\circ\text{C}$ ., on lead telluride for subcoolings of  $9.3$  to  $17.2^\circ\text{C}$ ., on stannous telluride for subcoolings of  $11.1$  to  $17.2^\circ\text{C}$ ., on lead sulfide for subcoolings of  $11.8$  to  $17.2^\circ\text{C}$ . and spontaneously in the bulk of the solution for subcoolings of  $13.2$  to  $17.2^\circ\text{C}$ ., for "waiting times" of 160 to 3 minutes, respectively. Therefore, it can be said that lead selenide is more effective than is lead telluride, which is more effective than is lead sulfide in nucleating these solutions. Each of the crystals is more effective than when nucleation is spontaneous in the bulk of the solution.

The "waiting time,"  $\Theta$ , for the formation of the potassium chloride nucleus on the various crystals

was obtained graphically from the relative conductivity-time measurements. The logarithm of the "waiting time,"  $\log \Theta$ , was found to be linear with the reciprocal of the square of the logarithm of the ratio of the mole fraction of the solute in the supersaturated solution to that in the saturated solution at the temperature of measurement,  $1/\log^2(x/x_0)$ . This relationship was linear over a temperature range of about  $10^\circ\text{C}$ .

Activation energies for the formation of potassium chloride nuclei on the various crystals were calculated for temperatures of  $31$  to  $41^\circ\text{C}$ . from the linear relationships of  $\log \Theta$  versus  $1/\log^2(x/x_0)$ . For a temperature of  $40^\circ\text{C}$ ., the calculated activation energies are: lead selenide, 1,418; lead telluride, 2,929; stannous telluride, 5,090; lead sulfide, 6,373; and for spontaneous nucleation, 7,350 gm.cal. per gm.mole. The smaller is the activation energy for the foreign crystals, the more effective is the crystal in nucleating supersaturated solutions. The activation energies for each crystal increase sharply as the saturation temperature is approached.

Surface energies of potassium chloride crystals relative to their supersaturated solutions and the foreign crystals were calculated to be 1.5 to 3.0 ergs per square centimeter. These values depend on the temperature and the crystal present.

The side lengths of nuclei of potassium chloride in equilibrium with their solutions have been calculated and are of the order of  $10^{-7}$  centimeters.

Microfilm copy of complete manuscript of 100 pages, \$1.25. Enlargements 6" x 8", 10¢ per page.

#### AN INVESTIGATION OF THE REACTION BETWEEN CARBON MONOXIDE AND HYDROGEN ON A NICKEL CATALYST AT PRESSURES ABOVE ONE ATMOSPHERE

(Publication No. 3793)

John Ardell Pursley, Ph.D.  
University of Michigan, 1951

The purpose of this investigation was to establish a correlation for the effect of the partial pressures of the reactants on the initial rate of reaction between carbon monoxide and hydrogen to form methane and water,  $\text{CO} + 3\text{H}_2 \rightarrow \text{CH}_4 + \text{H}_2\text{O}$ , on a specific nickel catalyst at elevated pressures.

An automatic continuous bench-scale pilot plant with maximum operating conditions of 16 standard cubic feet of gas per hour, 100 cc. of catalyst,  $750^\circ\text{F}$  and 600 psig has been designed and constructed. The reactor is a 2' x 3/4" ips. schedule 40 mild steel pipe with a jacket containing pressurized boiling fluids for temperature control. This plant was operated as a differential reaction system, and the initial reaction rates were derived from data obtained at low conversions over a range of temperatures, pressures, and gas concentrations. Infra-red spectrophotometric analysis was used.

The range of the investigation was limited to



conditions where side reactions and catalyst deactivation could be shown to be negligible. Under these conditions, i.e. maximum of 30% carbon monoxide, 700°F at atmospheric pressure, 600°F at 250 psia and 500°F at 400 psia, the initial reaction rates can be correlated within the limits of experimental accuracy by any rate controlling mechanism that yields an equation which reduces to approximately:

$$r_o = 0.75 (p_{CO}) / (p_{H_2})^{\frac{1}{2}}$$

at pressures greater than several atmospheres. The best agreement over the entire range is:

$$r_o = \frac{1.1(p_{CO}) (p_{H_2})^{\frac{1}{2}}}{1 + 1.5 (p_{H_2})}$$

where the partial pressures are expressed in atmospheres and the initial rate in mols of methane formed per hour per pound of catalyst. The correlation is within the limits of accuracy which are approximately  $\pm 11\%$  to  $\pm 57\%$  for the reaction rates in the high and low ranges respectively.

Microfilm copy of complete manuscript of 154 pages, \$1.93. Enlargements 6" x 8", 10¢ per page.

#### MASS TRANSFER IN LIQUID-LIQUID EXTRACTION

(Publication No. 3802)

Stanley Seltzer, Ph.D.  
University of Michigan, 1951

Mass transfer coefficients and transfer area were determined for various operating conditions in a spray type liquid-liquid extraction column. The system studied was water-acetic acid - methyl isobutyl ketone, with the ketone dispersed in the water. The transfer area was obtained by measurements of the drop size and drop velocities. The transfer coefficients were obtained from analyses of inlet and exit streams of both phases and samples of the continuous phase removed from two points within the column.

The drops were formed by injecting the ketone into the water phase through holes drilled in a horizontal plate. Variations of the drop size and the drop size dispersion as a function of the orifice size and ketone flow rate through the orifice were studied. Drop size measurements were made by photographing the drops in the column and measuring enlarged projections of the negatives. The concentration of acetic acid in the water phase varied from .00002 N to 0.2 N. Equilibrium data were taken in this range, and can be represented by the equation:

$$(3 + \log N_K) = 1.02621 (3 + \log N_W) - .37857$$

where  $N_K$  = Normality of acid in ketone phase

$N_W$  = Normality of acid in water phase

In the extraction column flow rates of both phases and the size and dispersion of the ketone drops were

varied. The water rate ranged from .68 cu.ft./hr. to 12.8 cu.ft./hr., the ketone rate from .348 cu.ft./hr. to 2.9 cu.ft./hr. The drop volumes ranged from  $.192 \times 10^{-6}$  cu.ft. to  $2.5 \times 10^{-6}$  cu.ft. The column diameter was 3 inches, the overall height 14 feet, and the distance between the sample points in the column was 4.5 feet.

Transfer areas, under the conditions studied ranged from 4.1 sq.ft. of transfer area per cubic foot of tower volume to 60 sq.ft. of transfer area per cu.ft. of tower volume. Transfer coefficients varied from .35 to 1.18 mols acetic acid transferred/(hr) (sq.ft. of transfer area) (mol acetic acid per cu.ft. of ketone). Complete correlations of transfer area and transfer coefficients would have to be based on a more complete study of all of the factors affecting these quantities than was made here. Variations of such factors as nozzle and column design, drop diameter dispersion, surface tension and densities would have to be studied. This investigation showed that it is possible to find both K and a in a modified form of commercial equipment, and that variations in a can be significant compared to variations in K, (where K is the coefficient of mass transfer, mols solute transferred/(hour) (square foot of transfer area) (mol acetic acid per cubic foot of ketone), and a is the transfer area per cubic foot of tower.)

Microfilm copy of complete manuscript of 159 pages, \$1.99. Enlargements 6" x 8", 10¢ per page.

#### MASS TRANSFER STUDIES IN COUNTERCURRENT, LIQUID-LIQUID EXTRACTION SYSTEMS

(Publication No. 3698)

Adam Edward Skrzec, Ph.D.  
Virginia Polytechnic Institute, 1952

The purpose of this investigation was to study the effect of phase velocity on the mass transfer coefficients in several liquid-liquid extraction systems, and to correlate the mass transfer coefficients with the physical properties of the components comprising each system. Three different three component liquid systems, cyclo-hexanol-acetic acid-water, normal butanol-acetic acid-water, methyl ethyl ketone-acetic acid-water, and five different two component liquid systems, cyclohexanol-water, methyl ethyl ketone-water, furfural-water, normal butanol-water, and nitromethane-water, were studied in a horizontal tube extractor. Since the individual coefficient is more fundamental and useful for design purposes, a correlation of the individual film coefficient with the physical properties enables the engineer to design equipment without first making experimental studies on the systems to be used.

Countercurrent studies were conducted in a horizontal, pyrex glass pipe, 96 inches long, and with an inside diameter of 1-1/2 inches. The extraction tests were conducted at approximately 27°C, with the solvent phase flow rates of 1,050 to 15,000

pounds per hour per square foot, and water phase flow rates of 1,000 to 15,000 pounds per hour per square foot. The transfer coefficient, calculated from experimental data, for the solvent through water increased linearly as the water phase flow rate was increased and the solvent rate was held constant. Increase in the solvent phase flow rate, at constant water flow rate, did not affect the transfer coefficient for solvent through water.

The coefficient for the transfer of water through the solvent film showed a very gradual increase with increasing flow rate of the solvent phase until a velocity ratio of 0.85 of the solvent phase to the water phase was reached. At higher ratios, the coefficient increased parabolically. This same coefficient decreased hyperbolically when the water phase flow rate was increased and the solvent rate held constant.

The individual coefficients for both the solvent and water phases were correlated with the empirical relationship derived by dimensional analysis, in a form consisting of relations between dimensionless numbers, and the results were expressed as follows;

for material transfer through the solvent film:

$$\frac{K_{sd}}{D_w} = 0.00665 \left( \frac{d\sigma}{M_s D_w} \right)^{.275} \left( \frac{M_s}{M_w} \right)^{.44} \left( \frac{M_s}{\rho_s D_w} \right)^{.63} \left( \frac{Re_s}{Re_w} \right)^{.785}$$

for material transfer through the water film:

$$\frac{K_{wd}}{D_s} = 0.000115 \left( \frac{d\sigma}{M_w D_s} \right)^{.16} \left( \frac{M_s}{M_w} \right)^{.44} \left( \frac{M_w}{\rho_w D_s} \right)^{.63} \left( \frac{dG_w}{M_w} \right)$$

where:

- k = transfer coefficient
- d = diameter of tube, or length of interface perpendicular to the direction of flow
- D = volumetric diffusivity
- G = mass velocity of phase
- $\rho$  = average density of phase
- m = viscosity of phase
- $\sigma$  = interfacial tension
- Re = Reynold number

subscripts,

- s = solvent phase
- w = water phase.

In the three component studies using acetic acid as the transferred solute, the over-all coefficient based on the solvent phase was found to increase parabolically when the water flow rate was increased and the solvent phase was held constant. The same coefficient was found to go through a minimum when the mass velocities of the two phases were almost equal for the tests where the solvent phase rate was varied and the water rate was held constant.

When these equations were used to evaluate the over-all transfer coefficients of three component systems, where acetic acid was the solute transferred from an organic solvent to water, the calculated over-all coefficient obtained after combination

of the two individual resistances was found to agree with the over-all coefficient determined experimentally in the seventeen comparisons made, with an average deviation of 6.5 per cent.

Microfilm copy of complete manuscript of 459 pages, \$5.74. Enlargements 6" x 8", 10¢ per page.

## ENGINEERING, CIVIL

### THE INSTABILITY OF TOP CHORDS OF PONY TRUSSES

(Publication No. 3768)

Lu-Shien Hu, Sc.D.

University of Michigan, 1952

This dissertation presents a theoretical method of analysis of the instability of top chords of pony trusses. In pony trusses, because of the absence of the top chord bracing, transverse frames which consist of floor beam and two verticals are the only means of preventing the top chords from moving laterally. In this dissertation the top chords are considered as beam-columns subjected to axial forces and supported on elastic deflectional springs which are provided by the equally-spaced transverse frames. The problem is then reduced to the determination of the spring constants k of the supports that are required to prevent the beam-column from buckling. Formulas which give the relation between axial forces P and spring constants k of the supports are derived from energy method using a few selected terms of the trigonometrical series. This problem has been solved previously for constant cross-section of the beam-column, constant axial forces in the beam-column, and constant spring constants of the equally spaced elastic supports. Variations of these variables are considered in this dissertation. Graphs are plotted for chords with parabolic variations of flexural rigidity ( $D = E_t I$ ) and axial forces but with constant intermediate elastic supports and rigid ends for a number of panels  $m = 2, 3, 4, 5, 6, 7$ , and 8. A correction factor is subsequently applied, if necessary, to give the desired variation of elastic supports. Tables are provided to facilitate the calculation of this correction factor.

Formulas which give the relation between the axial forces P and the spring constants k are linear in k and not too complicated in terms of P and D. They are generally in the following form:

$$\psi = \pi^4 \frac{F_{pq}^2 - f_p f_q}{2F_{pq} + f_p + f_q} \lambda$$

in which both F and f are linear in  $\mu$ , where



$$\mu = \frac{P l^2}{\pi^2 D}$$

$$\varphi = \frac{k l^3}{D}$$

$P$  = axial force

= panel length of the pony truss

$D = E_t I$  = flexural rigidity

$\lambda$  = a correction factor for non-rigid ends and unequal intermediate elastic supports.

Exact solutions are available for this problem with

1. Rigid ends and constant intermediate elastic supports,
2. Constant  $D$  and  $P$ .

For comparison the results from the proposed method are listed in the following table together with those from exact method.

$\varphi$ \ $m$	2	3	4	5	6	7	9	$\infty$
Exact Method	19.7	29.6	33.7	35.8	36.9	37.5	38.2	$4\pi^2$
Proposed Method	19.6	29.3	33.3	35.3	36.4	37.1	37.8	$0.4\pi^4$

in which  $m$  = number of panels of the pony truss.

For simple span pony trusses, results usually can be obtained directly from the graphs and correction factor can be calculated by means of the tables. However, for continuous pony trusses, the general formula must be solved by evaluating a few constants by direct summation. Numerical examples are provided at the end of the dissertation to illustrate the procedure.

A change of modulus of elasticity  $E$  after the proportional limit is reached is also considered by using the tangent modulus  $E_t$ . The resistance to buckling is quite sensitive to this change in the value of  $E$ .

One hundred and three references are listed at the end of the dissertation.

Microfilm copy of complete manuscript of 147 pages, \$1.84. Enlargements 6" x 8", 10¢ per page.

## ENGINEERING, ELECTRICAL

### MEASUREMENT OF THE VELOCITY OF PROPAGATION OF SOUND WAVE IN THE OCEAN AS A CONTINUOUS FUNCTION OF DEPTH

(Publication No. 3725)

Richard Kemp Brown, Ph.D.  
University of Michigan, 1952

A new type of underwater sound velocity meter is described which makes continuous recordings of the

velocity of propagation of a sound wave in the ocean as a function of depth. The meter improves the accuracy of present methods of velocity determination by its ability to measure sound velocity directly rather than merely the temperature of the water. It employs a phase-comparison system of measurement, transmitting a 510-kilocycle acoustic wave through a 1-foot sample of sea water. Two quartz crystals are used as transducer elements. The voltage across the transmitting crystal is compared in phase with the voltage across the receiving crystal, and the phase difference between these two voltages is shown to be a nearly linear function of the velocity of propagation of the acoustic wave.

As a calibration for the velocity meter, a comparison system for measuring the wavelength and the velocity of a sound wave in the water of a laboratory tank has been set up. Wavelength is determined by measuring the distance between equiphase planes. The results of this series of tests indicates sound velocities higher than those predicted from tables in current use.

Velocity recordings and measurements of temperature, salinity, and pressure are reported for several test locations in the Atlantic Ocean. The measured difference in the sound velocity between ocean layers has been compared with the predicted velocity difference as determined from tables, and the agreement has been found to be good.

Microfilm copy of complete manuscript of 137 pages, \$1.71. Enlargements 6" x 8", 10¢ per page.

### NOISE STUDY ON ELECTRICAL POWER SYSTEMS WITH SPECIAL REFERENCE TO SUPERIMPOSED SIGNALLING

(Publication No. 3941)

Woo Fong Chow, Ph.D.  
University of Minnesota, 1952

Interference caused by harmonics of the power supply frequency were a serious and troublesome nuisance for a long time. It was a major engineering feat to develop proper coordination between power and communication circuits. Much attention and labor has been expended in the design of electric generators and rotary converter machines to reduce the harmonic content of the output wave form to a satisfactory low level from the standpoint of inductive interference with telephone lines. However, harmonic noise is still a serious and disturbing factor in the problems of superimposed signalling. Giving attention to these problems, the purposes of this study are (1) to examine systematically the noise distribution in the low frequency spectrum of the power frequency, from fundamental to its 20th harmonic, (2) to search the low frequency spectrum particularly for frequency regions relatively free from noise interference and hence desirable as super-imposed signalling bands.

The low frequency spectrum is examined for noise in two ways, first, by means of a theoretical analysis from the standpoint of the machines and devices which may produce noise, and second, experimental data are taken at several locations on secondary distribution circuits of the Northern States Power Company in and near Minneapolis, Minnesota, in order to measure the actual relative noise components existing in a representative power system serving a community of about one million people.

The paper is divided into seven sections. The first three sections deal with the possible noises generated by rotating machines, transformers, lines, and rectifiers. The 4th and 5th sections deal, respectively, with harmonic components generated by home appliances, and those existing on the power lines and transmitted to the premises of the consumer. The last two sections are devoted to topics of superimposed signalling. It is found that all harmonics of integer order of the power frequency are in an approximate steady state. The harmonic with the largest amplitude was found to be the 5th at a level 30 decibels below the fundamental. Noise components which are noninteger orders of the fundamental were found to be resolvable into two parts, 1) a steady state voltage whose magnitude is around 100 db below the fundamental and 2) a transient voltage whose measured maximum value was about 67 db below the fundamental. The frequency of occurrence of this transient noise was estimated to be about once in a period of one hour. At each appearance the transient lasted about one minute. Because of the infrequent appearance and the short duration of the transient its disturbing effect, when judged on a probability basis, is 18 decibels lower than if it remained steady at its maximum value. In the over all picture of disturbance caused by integer and non-integer harmonics of the fundamental it is found that there are frequency regions which are relatively free from disturbance. These regions are located between each pair of two successive integer harmonics. The most favorable choice of signal frequency, in so far as noise disturbance to the superimposed signal is concerned, is a frequency value which is the arithmetic mean of two successive integer harmonic numbers. In so far as signal attenuation is concerned the choice of any one signal frequency will depend to some extent on the make up of the power system and of its consumer load. For the power system studied, which may be taken as roughly representative of power systems in metropolitan communities of about one million population in the United States, the signal frequency choice falls within the interval 210 to 570 cps. The frequency band permits the choice of 7 central non-integer harmonic frequencies. This is considered to be ample for all presently conceived needs of multiple channel signal systems.

Microfilm copy of complete manuscript of 151 pages, \$1.89. Enlargements 6" x 8", 10¢ per page.

# SCATTERING AND ABSORPTION OF WATER DROPLETS AT MILLIMETER WAVELENGTHS

(Publication No. 3736)

Chiao-Min Chu, Ph.D.  
University of Michigan, 1952

The scattering and absorption of energy from plane electromagnetic waves impinging on spherical semi-conductors is considered. Though this problem was solved formally by Mie in 1908, and was thoroughly reviewed by Stratton in his *Electromagnetic Theory*, the mathematical expressions resulting are complicated to the extent that calculations cannot be made generally without extended further work. Previous calculations have usually been made for spherical bodies assumed to be either perfect conductors or perfect dielectrics, and for bodies assumed to be either much larger or much smaller than the wavelength of the incident wave. For these limiting conditions asymptotic expressions have been developed which reduce the calculation burden. These simplifications, however, cannot be used if the wavelength and the size of the spherical object have the same magnitudes, or if the index of refraction of the object is a complex number.

This report, in particular, develops methods for calculating the scattering and absorption of water droplets of varying sizes (diameters  $D = 0.5$  to  $5$  millimeters), for a range of wavelengths of the same magnitude, taking into account the complex index of refraction of the droplets as a function of wavelength and temperature.

The water droplet problem became of increasing importance during World War II with the use of ultra-high frequencies and the development of radar techniques. The scattering of energy by droplets is the central core of the ability to obtain sufficient "back scattering" from water droplet (thunderstorm) types of clouds to provide cloud detection by radar; of the ability of radar to penetrate clouds to "see" targets beyond; and of the ability to propagate energy, without excessive attenuation, through various types and degrees of rain for both radar and communication uses.

Advancing techniques have led to the use of shorter and shorter wavelengths  $\lambda$  - 10 cm, then 3 cm, then 1.25 cm. Further developments have presently made it possible to generate continuous waves in the millimeter wavelength range - 6 mm, which is approximately the size of the largest water droplet.

In the wavelength range from 10 cm to 1 mm the relative dielectric constant of water (at  $18^\circ\text{C}$ ) decreases from approximately 80 to 6, while the loss factor has a maximum at approximately 1.5 cm. These variations in the electrical properties of water have also been taken into account in the calculations given in this report.

Calculation of the scattered and absorbed energies involve ratios of spherical Bessel functions and their derivatives with complex arguments. Tables of these quantities are not available at present. A method is presented in this report by which they can be



evaluated by reducing them to combinations of elementary real functions.

The results on scattering and absorption are given graphically and in tabular form as functions of  $\rho = \pi D/\lambda$  for wavelengths between 1 and 10 mm. Given also are values of attenuation caused by light medium and heavy rains composed of typical known drop size distributions.

Microfilm copy of complete manuscript of 175 pages, \$2.19. Enlargements 6" x 8", 10¢ per page.

**SYNTHESIS OF A RESISTANCE -  
CAPACITANCE FILTER WHOSE  
POWER INSERTION RATIO APPROXIMATES  
A PRESCRIBED FUNCTION OF FREQUENCY**

(Publication No. 3669)

Noah Herbert Kramer, Ph.D.  
Michigan State College, 1952

An R-C Low- Pass Filter whose Power Insertion Ratio approximates a prescribed function of frequency is synthesized.

The Filter is in the form of a symmetrical lattice with prescribed, but equal, terminating resistors.

The problem of approximation is first considered.

The realization of a lattice that approximates a trapezoidal pattern is then shown.

A few realization conditions, peculiar to this thesis are then discussed and some avenues for further study are made available.

Microfilm copy of complete manuscript of 48 pages, \$1.00. Enlargements 6" x 8", 10¢ per page.

**UTILIZATION OF REFLECTIONS  
FROM TRANSMISSION LINE ELEMENTS  
TO PRODUCE POSITIVE ELECTRICAL PULSES  
OF 0.006 MICROSECONDS DURATION  
AT HIGH REPETITION RATES**

(Publication No. 3670)

Frank Murray Pelton, Ph.D.  
Michigan State College, 1950

The art of short pulse production has previously been limited by the lack of a suitable interstage inversion element usable for pulses of less than 0.05 microseconds duration. This paper treats the use of the short circuit terminated transmission line to accomplish this inversion.

Inherent in the process when applied to triangular pulses is a desirable reduction in pulse duration by a factor of two. Thus it is relatively simple to accomplish an overall reduction of pulse duration of more than two to one per amplifier stage.

Application of this method was made in a pulse generator and amplifier capable of producing 100 watt

positive triangular pulses of 0.005 microseconds duration at a pulse repetition rate of 800 kc.

The study of the production of pulses less than 0.005 microseconds and at repetition rates of greater than 800 kc. is contemplated as the study made shows no limitation of these values.

Microfilm copy of complete manuscript of 80 pages, \$1.00. Enlargements 6" x 8", 10¢ per page.

**THE FUSING OF CERAMIC COLORS  
ONTO GLASS BY DIELECTRIC HEATING**

(Publication No. 3803)

Queenie Halford Shirley, Ph.D.  
University of Michigan, 1952

The time required to fuse vitrifiable enamels (ceramic colors) onto glass, by means of microwave power, is about one sixtieth the time required to accomplish the same result in an ordinary decorating lehr (oven) under normal conditions.

The glass, on which the vitrifiable enamels are to be fused, is placed in a cavity resonator. One or two standard QK continuous wave magnetrons are used to supply the necessary power to the circuit associated with the cavity resonator. The circuit, which is constructed of waveguide, has two parallel branches in the center section. These two parallel branches, one of which contains a phase shifter, are used to control the amount of power transmitted to the glass. This in turn controls the temperature rise in the glass.

A detailed analysis of the behavior of the individual components used in the circuit is given. The experimental data given will clarify the operating characteristics of these components, even if they are used for an entirely different purpose.

The fact that this type of circuit can be used for many other purposes than the one described in this thesis, made a detailed analysis of the operation of this type of circuit desirable.

A copper-constantan thermocouple, enclosed in non-magnetic metal tubing, was used to measure the temperature of the glass. The low reading recorded on the potentiometer at the time the ceramic colors fused onto the glass made it necessary to calibrate the thermocouple in the presence of the high frequency field. Several methods were tried. The melting points of crystals, used as standards against which to calibrate mercury thermometers, was one method used. The crystals appear to melt at a much lower temperature in the presence of a high frequency field than under normal conditions. The experimental evidence obtained is contradictory in some respects and no conclusive reason was found for the low reading observed on the potentiometer associated with the thermocouple.

The general conclusions reached are: 1) It is possible to fuse vitrifiable enamels onto glass by means of microwave power, but more experimental work is required to make the process commercially

feasible. 2) The fusing of vitrifiable enamels onto glass can be accomplished by this method in about one sixtieth the time necessary to accomplish the same result in an ordinary decorating Lehr. 3) A circuit of the type used, with slight modifications, should have uses other than the one described in this thesis. 4) This type of circuit can be used to protect one or more magnetrons against high voltage standing wave ratios.

Microfilm copy of complete manuscript of 171 pages, \$2.14. Enlargements 6" x 8", 10¢ per page.

**THE OPENING OF  
THE PROPORTIONAL REGION  
TO BETA COUNTING AND THE DEVELOPMENT  
OF TWO FLOW BETA COUNTERS**

(Publication No. 3813)

Ernest Henry Wakefield, Ph.D.  
University of Michigan, 1952

This research was initiated to investigate the suitability of the proportional region for counting the softer beta particles such as those emitted by  $C^{14}$  or  $S^{35}$  isotopes, the maximum energies of which are about 150 KEV.

When the research was begun (1946), radiation-detectors in use (the Geiger-Müller counter, the ion chamber, and certain proportional counters) gave the isotope-user difficulty because of their microphonics, their slowness, and the tendency of their windows to admit air, to absorb radiation, and to break easily. The author believed that new types of flow proportional beta counters might solve these problems.

In a proportional counter, the signal  $dv = \frac{dq}{c}$  is proportional both to the ions formed by the initial radiation event and the gas amplification factor  $A$ . Since  $A$  was a function of the type of gas and the voltage across an electrode system containing the gas, a gas in which the parameter  $A$  varied least with respect to the voltage was desired. This gas could not be electro-negative, poisonous, corrosive, scarce, expensive, or operative only at extreme voltage. Pure methane fulfilled all the conditions.

Experiments began with a windowless counter with the anode coaxial with the cathode. While the slope of its characteristic curve was steep, the counter had promising aspects. Given a looped anode and proper length to volume ratio, its performance showed significant improvement. Basic tolerance experiments on pressure and air-contamination proved favorable. Tests on reproducibility, hysteresis, gas-flow rate, position of sample, effect of circuit-input sensitivity, and of different isotopes indicated success. In a windowed proportional counter, internal pressure was introduced to preclude inward seepage of air, and conduction in the window prevented accumulation of charges. Tests

of the important parameters of the windowed counter (in which the geometry could be changed) also announced success.

Ultimately, the research led to three flow proportional beta counters, two windowless — the slide flow beta counter and the preflush flow counter — and a windowed counter. All were practically free from the problems of earlier detectors. All have now been developed into effective counters of beta gamma radiations and, with suitable adjustment of the gas amplification and with the electronic circuit unchanged, can distinguish alpha and beta radiations. Limited only by the electronic circuit, they are exceedingly fast. They have a geometry approaching  $2\pi$  steradians. Their method of sample introduction and their flow principle give them almost unlimited life.

Furthermore, they tolerate as much as ten per cent of air as well as changes in altitude, temperature, and gas flow rate. They give remarkably reproducible data, plateaus 600 volts long, and slopes of approximately 0.1 per cent per hundred volts.

It is clear that the beta proportional region has been found excellent for radiation detection research. The counters that have been developed for operation in this field are apparently a lasting contribution to the instruments for radioactive measurement and open up new research possibilities. In the counting of soft beta radiations they are at present (1952) without peer.

Microfilm copy of complete manuscript of 137 pages, \$1.71. Enlargements 6" x 8", 10¢ per page.

## ENGINEERING, MECHANICAL

### AN ANALYTICAL STUDY OF THE DIE CASTING PROCESS

(Publication No. 3916)

Bruno Sachs, Ph.D.  
Columbia University, 1952

Forcing of molten metal by the application of pressure into steel dies, the process called die casting, is by now an important factor in the economical mass production of non-ferrous metal parts. Progress in the method of production of die castings has followed empirical lines.

The purpose of this study was to provide the mathematical frame work for a working theory on die casting. In developing the theory, the die casting operation, also called "shot," has been followed through with as few simplifications as possible. The following factors have been accounted for: mechanical friction and flow losses in the die casting machine, the die and the cavity-air system; inertia forces; opening period of the operating valve and venting conditions in the die.

Based on fundamental laws of mechanics, hydro-



and thermodynamics, a system of equations has been developed to describe pressures and velocities of the shot mechanism, die filling time, optimum gating and venting conditions, and the resulting porosity of the casting. These equations contain as parameters geometrical and physical quantities pertaining to the die casting machine, die and the metal.

The equations developed in the paper were then applied to the A.S.T.M. Committee B-6 test casting, a prototype aluminum alloy test casting, assumed to be produced under equal thermal conditions with four different gate thicknesses on eleven different die casting machines.

The results of the analysis led to the following conclusions:

1. Satisfactory die castings (from the viewpoint of surface quality, sharpness of outline and porosity) can be produced on all types of die casting machines provided thermal conditions, venting factor, gate and vent areas are properly coordinated with the characteristics of the particular machine and metal system.

2. The optimum gate thickness for minimum porosity can be calculated.

3. Small deviations from the optimum gate thickness will bring about a pronounced increase of porosity of castings in the case of direct air gooseneck machines. Hydraulically driven cold and hot chamber plunger type machines are much less sensitive in this respect.

4. The metal pressure and velocity and the die filling time can be calculated in terms of the machine and metal system characteristics, accumulator or tank pressure, accumulator factor, and cavity air pressure factor which includes the venting factor.

5. Further research work to obtain solidification data is desirable.

The theoretical approach presented in this study was partially verified by calculating the metal velocity for the condition of the Koester and Goehring\* set-up. These authors devised an arrangement to measure experimentally the steady state velocity of a free jet which emerges from the machine nozzle of a small plunger type (hot chamber) die casting machine. The agreement was found to be between 2 - 4.5%.

\*Koester, Werner, and Karl Doehring, "Ueber den Einstroem - und Fuellvorgang bei Spritzguss an Hand kinematographischer Aufnahmen," Die Gieserei, Heft 26 (26.Dezember 1941).

Microfilm copy of complete manuscript of 91 pages, \$1.14. Enlargements 6" x 8", 10¢ per page.

# INVESTIGATION OF THE EFFECTS OF THE ENGINE MECHANISMS ON THE TORSIONAL VIBRATIONS OF CRANKSHAFTS

(Publication No. 3964)

Chang-Kaing Tsai, Ph.D.  
University of Minnesota, 1952

In the investigation of the torsional vibrations of engines, it is customary to replace (1) the complicated structure of the crankshaft by an elastic system having the same torsional rigidity, and (2) the attached engine mechanisms by rotating circular disks with moments of inertia equal to the mean values of the variable moments of inertia of the corresponding reciprocating mechanisms. The equivalent disk is calculated by first replacing the piston mass by a mass equal to one-half the piston mass at the crankpin, which is in turn reduced to an equivalent circular disk. This equivalent system has been commonly used because of its simplicity and ease of solution. This thesis was undertaken to determine both mathematically and experimentally the behavior of the actual system and to evaluate the effects of the simplified assumptions normally made.

For an engine, the piston assembly connected to the crankpin through the connecting rod varies in speed twice from zero to approximately  $r$  (assuming crank radius is  $r$ ) when the crankshaft rotates one revolution at a constant angular speed. Therefore, the kinetic energy of the engine mechanism, and thus the equivalent moment of inertia, changes with respect to time when the crankshaft is rotating. If one takes the variation in moments of inertia into consideration, the system of differential equations of motion will be non-linear and will have periodic coefficients. With reasonable assumptions the problem can be transformed into a system of linear differential equations with periodic coefficients. The variation in moments of inertia also induces exciting torques on the system. By use of the method of perturbation, it can be found that there are critical regions rather than specific critical speeds.

The experimental set-up represents schematically a single cylinder engine connected by a long torsionally flexible shaft to a flywheel, the gas pressure in the cylinder being omitted. The system was driven by a DC motor through a pulley located at the node of the system. SR-4 strain gages were glued on the surface of the shaft to pick up the torsional stresses. The terminals of the strain gages were led out through slip rings and mercury troughs to a Wheatstone bridge circuit. When the shaft was rotating, the signal voltages from the bridge circuit were recorded on the ruled paper of a Brush Oscillograph. The formulas which give the relations between the signal voltages, the torsional stresses and the amplitudes of vibration of the crank were derived. The records of the tests show very clearly the six critical speeds due to the first six harmonics of the exciting torque induced by the variation in moment of inertia of the engine mechanism. The records also

verified the theory that the critical speeds would separate into regions.

Microfilm copy of complete manuscript of 135 pages, \$1.69. Enlargements 6" x 8", 10¢ per page

## ENGINEERING, METALLURGICAL

### A STUDY OF THE DISSOLUTION OF TITANIUM IN ACIDS WITH AMMONIUM FLUORIDE ADDED

(Publication No. 3837)

Charles Burroughs Gill, Ph.D.  
University of Missouri, 1952

The dissolution of titanium in several acids containing ammonium fluoride was studied in this investigation. Qualitative tests made in varying concentrations of several weak and strong acids, HCl, HNO<sub>3</sub>, H<sub>2</sub>SO<sub>4</sub>, HClO<sub>4</sub>, CH<sub>3</sub>COOH, HCOOH and CF<sub>3</sub>COOH, showed no attack on titanium by the acids themselves, but a strong attack when ammonium or sodium fluoride was added to the acids.

The law of mass action holds quite well when applied to the equation



for the formation of HF from NH<sub>4</sub>F added to H<sub>2</sub>SO<sub>4</sub>, with this HF formed dissolving the titanium.

Further quantitative studies were made of the rates of dissolution of titanium in concentrations of H<sub>2</sub>SO<sub>4</sub> and HCl from 0.5N to 10N with a constant concentration of 1/20N NH<sub>4</sub>F added; of constant concentrations of 2N and 4N H<sub>2</sub>SO<sub>4</sub> with the concentration of NH<sub>4</sub>F added varying from 0.05N to 1N, and 0.05 to 2N, respectively; and of a constant concentration of 2N HCl with the NH<sub>4</sub>F added varying from 0.05N to 1N. The maximum average rates of dissolution increased on a straight line relationship between the rate of dissolution and the normality of the concentration being varied, in all instances. The only exceptions being with concentrations of less than 0.5N NH<sub>4</sub>F added to 2N HCl and 4N H<sub>2</sub>SO<sub>4</sub>, in which cases the relationship was a slightly curved instead of straight line function. The rates of dissolution were much higher for tests made with increasing concentrations of NH<sub>4</sub>F in constant concentrations of H<sub>2</sub>SO<sub>4</sub> and HCl, than in increasing concentrations of H<sub>2</sub>SO<sub>4</sub> and HCl with constant additions of NH<sub>4</sub>F. In every instance the rate of dissolution was greater in HCl plus NH<sub>4</sub>F than in H<sub>2</sub>SO<sub>4</sub> plus NH<sub>4</sub>F. Rates of dissolution in 2N H<sub>2</sub>SO<sub>4</sub> with increasing concentrations of NH<sub>4</sub>F from 1/20N N to 5.77N, gave increases of 32.7 mm<sup>3</sup>/cm<sup>2</sup>-min. in 2N H<sub>2</sub>SO<sub>4</sub> plus 1/20N NH<sub>4</sub>F to 560.6 mm<sup>3</sup>/cm<sup>2</sup>-min. in 2N H<sub>2</sub>SO<sub>4</sub> plus 4N NH<sub>4</sub>F, then decreased to 35.14 mm<sup>3</sup>/cm<sup>2</sup>-min. in 2N H<sub>2</sub>SO<sub>4</sub> plus 5.77N NH<sub>4</sub>F. The rate of dissolution in pure HF increased rapidly with increasing concentrations of HF, on a straight line relationship between the rate of dissolution and Normality of the HF.

It was shown that H<sub>2</sub>SO<sub>4</sub> and HCl also contribute to the rate of dissolution if HF is present.

Electrode potentials developed by Ti in 2N H<sub>2</sub>SO<sub>4</sub> with increasing concentrations of NH<sub>4</sub>F from 1/20N NH<sub>4</sub>F to 5.77N NH<sub>4</sub>F, and in pure 0.5N to 3N HF were measured. These electrode potentials decreased from -0.572 volts (H<sub>2</sub> scale) in 2N H<sub>2</sub>SO<sub>4</sub> plus 1/20N NH<sub>4</sub>F to -0.910 volts in 2N H<sub>2</sub>SO<sub>4</sub> plus 5.77N NH<sub>4</sub>F. The electrode potential of Ti in pure HF remained constant at -0.78 volts, irregardless of HF concentrations.

Metal salts of platinum, gold, copper, nickel, lead, iron and manganese were added to 1N HF during the dissolution of titanium, and only in the case of the platinum addition was there a change in the electrode potential. The potential rising from -0.819 volts (H<sub>2</sub> scale) to -0.653 volts.

The rate of dissolution increased considerably when platinum salts were added to the dissolving acid, and decreased when agar-agar was added.

A study was made of the passivation phenomenon noted for the Ti, which manifests itself in that when large amounts of NH<sub>4</sub>F were added to the 2N H<sub>2</sub>SO<sub>4</sub> solution the rate of dissolution decreased, but the electrode potential of the Ti continued to become more negative. This feature of a dropping electrode potential during passivation is the reverse of that generally observed. The passivation phenomena was shown to be due to increases in the over-voltage of the cathodes of local cells on the titanium surface, when NH<sub>4</sub>F is added to the dissolving acid. The activity of these local cathodes governs the rate of dissolution of titanium. The changing of the electrode potential had no effect on passivation, and the formation of a surface film on the titanium only a slight, secondary effect.

Microfilm copy of complete manuscript of 250 pages, \$3.13. Enlargements 6" x 8", 10¢ per page.

### THE INFLUENCE OF PHOSPHORUS ON INTERNAL SHRINKAGE AND HIGH TEMPERATURE TENSILE PROPERTIES OF ALLOY GRAY IRON

(Publication No. 3758)

John Charles Hamaker, Jr., Ph.D.  
University of Michigan, 1951

This investigation was undertaken to determine the mechanism by which phosphorus and certain alloys produce internal shrinkage voids in gray iron and to study the effect of phosphorus and alloys on its tensile properties under conditions encountered in the formation of hot tears.

The influence of phosphorus and alloys on internal shrinkage porosity in a 3.25% T.C., 2.25% Si gray iron was determined by precision density measurements on unfed four inch cube castings. Molybdenum additions produced the greatest internal shrinkage tendency, concentrating it in visible porous regions, while chromium additions resulted in more widespread microporosity of lesser magnitude. Nickel



reduced the microporosity of plain iron slightly but had little effect on the shrinkage tendencies of molybdenum or chromium irons. Visible porosity appeared in a Ni-Cr-Mo iron when the phosphorus content was raised from 0.04 to 0.06%, and increased steadily in magnitude to over 2 cc. per four inch cube at 0.18% P. Variations in carbon or silicon of 0.25% above or below the base content had a negligible effect on the magnitude of shrinkage voids.

From an analysis of cooling curves and the variables affecting internal porosity, it was concluded that the liquid and solidification contraction of the low melting network of phosphide eutectic in the solidified iron could provide the only logical mechanism for this type of void formation. Metallographic and analytical studies revealed that both molybdenum and chromium segregate strongly to the phosphide eutectic, approaching saturation contents of approximately 8.3% Mo and 2.4% Cr in the eutectic. This segregation greatly increases the volume of phosphide eutectic and changes the phosphide solidification from the stable Fe-Fe<sub>3</sub>P-Graphite form to the metastable Fe-Fe<sub>3</sub>P-Fe<sub>3</sub>C form, with a drastic increase in its contraction. Nickel shows no tendency for segregation to the phosphide eutectic and does not change its properties appreciably.

Measurements of the liquid, solidification, and solid contractions of synthetic phosphide eutectic compositions permitted the calculation of theoretical four inch cube void volumes produced by phosphide contraction. These values gave an excellent quantitative check with the measured void volumes, and many of the anomalies observed in industrial research on internal shrinkage could be explained.

In order to study the properties of gray iron under hot tearing conditions, a procedure was developed for tensile testing on direct cooling from the liquid state in a sand mold. Forty-four tensile tests at temperatures of 2050° to 1650°F. on a 2.90% T.C., 2.10% Si base iron containing various phosphorus and alloy additions revealed that 0.04 to 0.16% P irons are most susceptible to hot tears in the range 1900° to 1800°F., while 0.25% P irons are susceptible from 1900° to 1700°F. The tensile strength in these ranges varied from 1600 to 3500 psi. An increase in phosphorus from 0.04 to 0.25% decreased the strength of alloy irons by 30 to 40% in the hot tearing range, while plain irons experienced a strength reduction of only 14%. The addition of 1.00% Cr or 1.10% Mo reduced the strength of a 0.12% P iron by 30%, while 1.85% Ni did not affect its hot tearing tendency.

Microfilm copy of complete manuscript of 223 pages, \$2.79. Enlargements 6" x 8", 10¢ per page.

## AN INVESTIGATION OF THE DEFORMATION TEXTURES OF TITANIUM

(Publication No. 3865)

Dean Nesbit Williams, Ph.D.  
University of Missouri, 1952

The textures of deformed titanium were determined using a modification of the Schulz-Decker Geiger counter technique. This technique allowed semiquantitative pole figures of high accuracy to be constructed. Pole figures were constructed for the 10 $\bar{1}0$ , 0001, and 10 $\bar{1}1$  planes.

Samples of iodide titanium deformed in compression by compression between parallel plates and by compression rolling were examined after reductions in thickness varying from 24.1 to 98.9 percent. A [0001] texture rotated up to thirty degrees from the compression axis was found. As the amount of reduction increased, the angle of the [0001] rotation decreased, reaching seventeen and one-half degrees at 98.9 percent. The final texture was independent of the method of compression.

Cold rolled textures of iodide titanium and of three grades of commercial titanium were determined. The iodide titanium and two of the three grades of commercial titanium showed a (0001) [10 $\bar{1}0$ ] texture rotated thirty degrees or more toward the transverse direction. The greatest preferred orientation was found in the 10 $\bar{1}0$  pole figure in which a <10 $\bar{1}0$ > direction tended strongly to be located in the rolling direction. The third commercial titanium sample showed a second texture, in addition to the above texture, in which the (0001) rotation was twenty degrees toward the rolling direction.

The deformation process in titanium was examined theoretically using the method developed by Calnan and Clews and the necessary modes of slip and twinning to give the observed compression and cold rolling textures and the reported drawing texture were determined. The {0001} <11 $\bar{2}0$ >, {10 $\bar{1}1$ } <11 $\bar{2}0$ >, and {10 $\bar{1}0$ } <11 $\bar{2}0$ > slip systems and the {10 $\bar{1}2$ }, {11 $\bar{2}2$ }, and {11 $\bar{2}1$ } twinning systems were considered individually and the textures which would result from their action determined. By combining the slip and twinning systems so that the critical shear stress for slip,  $C_s$ , and for twinning,  $C_t$ , were related as follows,

$$C_{S0001} = 1.1 C_{S10\bar{1}1} = 1.02 C_{S10\bar{1}0} = C_{t10\bar{1}2} = C_{t11\bar{2}2},$$

the observed tension and compression textures could be explained. These modes of slip and twinning were also used successfully to develop a theoretical 0001 pole figure for cold rolled titanium which was similar in form to the measured texture.

Microfilm copy of complete manuscript of 185 pages, \$2.31. Enlargements 6" x 8", 10¢ per page.

## ENGINEERING, MINING

THE MINERAL POSITION  
OF CANADA

(Publication No. 3878)

John Stanley Carman, Ph.D.  
Columbia University, 1952

At the beginning of the 20th Century, Canada was one of the least important mineral producing nations. Its essentially agrarian economy appeared to have few of the ingredients upon which to develop an industrialized society. During the 19th Century, discoveries were either relatively unimportant and shortlived or contained ores that were in slight demand at that time. Deposits easier of access were attracting most of the attention in other parts of the world. Canadian mining had not yet had the required record of success to generate much interest.

Over the past fifty years, the picture has changed radically. The Dominion has achieved significant rank among industrial nations and one of the most important factors of growth has been the constantly increasing importance of mineral extraction. The gold and silver finds during the first decade of the century focussed the spotlight upon Canada. Particularly influential has been the vastly expanded global appetite for minerals that has more and more led to development of orebodies held in scant regard in earlier years. To-day the Dominion is the world's largest exporter of nonferrous metals and as such a vital element in the defense of the Western World.

The development of mining in Canada has been and will continue to be confronted by very decided physical barriers. Geological conditions are encouraging but topography, distance, climate, and the impossibility of diversified economies in the North, place heavy burdens upon the mine-makers. In compensation, the mining industry has generally operated within an unusually favorable environment in regard to the attitudes of governments in matters dealing with mine taxation and financing. The unique characteristics of mining operations have not been overlooked by those who frame and administer the Canadian statutes.

The outstanding weakness in the mineral deposition pattern of Canada is that the extensive coal measures are located remote from the major industrial centers. A decade ago an equally weighty factor minimizing the Dominion's strength as a mining nation was the lack of iron ore and petroleum. Subsequent discoveries have gone far in changing this condition.

To-date the importance of Canada as a mineral producer has stemmed from the output of precious metals and non-ferrous metals. With these commodities, the Dominion is in the fore-front of world producers. A significant characteristic has been the concentration of the production of the non-ferrous metals in regard to commercial control and areas of deposition. However, a dynamic post-war rate of discovery has expanded the base and provided sound

proof of the youth of the Canadian mining industry. Among the non-ferrous metals, it is the ferro-alloying elements such as manganese and chromite in which Canada is deficient. There are other major lacks but none as significant in a tonnage sense. The Dominion is as well-endowed in minerals as any country in the world except the United States and Russia. Nevertheless, it is self-sufficient in only fifty per cent of the principal strategic minerals.

Mining plays a fundamental role in the Canadian economy as a major prop to the industrial plant, in bolstering regional economies, as the primary incentive for advancing the frontier, as a major earner of foreign exchange, and finally as a strategic bulwark of the highest importance.

Microfilm copy of complete manuscript of 291 pages, \$3.64. Enlargements 6" x 8", 10¢ per page.

## ENGINEERING, MECHANICS

THE TURBULENT BOUNDARY LAYER  
IN THE INLET REGION OF  
SMOOTH PIPES

(Publication No. 3945)

James Stafford Holdhusen, Ph.D.  
University of Minnesota, 1952

When fluid flows from a nozzle into a pipe, the velocity at the entrance to the pipe is essentially constant transverse to the flow direction. At some section farther downstream, however, the flow becomes stabilized with the velocity varying from a maximum at the pipe axis to a minimum at the pipe wall. The properties of the stream in the region of established flow can be determined on the basis of previous investigations by using the Darcy law. In the region of flow establishment, on the other hand, the Darcy law cannot be used because the changing velocity distribution causes a variation in the momentum flux. The effect of the variation in velocity is to cause the flow to lose pressure and energy at a faster rate in the inlet region than in the fully established flow; this effect will be of major importance if the pipe is short.

The flow process in the inlet region for turbulent flow in smooth pipes was analyzed by assuming that the region of retarded velocity in the inlet region was confined to a boundary layer whose thickness increased in the direction of flow until it became equal to the pipe radius. A velocity distribution for the boundary layer was chosen so that the Karman-Prandtl distribution was obtained at the end of the inlet region (in order that the pressure gradient at the end of the inlet region would merge smoothly with the standard values in the established flow) and the equation of motion for a transverse section of the flow was integrated numerically along the inlet region.



After the variation of the boundary layer thickness had thus been obtained, the bulk properties of the flow, such as pressure gradient and head loss, were calculated and compared with the data of various investigators. Good agreement with experiment was obtained, especially for the pressure drop, so that the main conclusions of the analysis may be accepted. These conclusions are: (a) the pressure gradient at the upstream end of the pipe will be from 60% to 120% greater than normal, depending on the Reynold's number, (b) the rate of head loss at the upstream end of the pipe will be from 30% to 45% greater than normal, depending on the Reynold's number, (c) after ten diameters of flow, the pressure gradient and rate of head loss will be only very slightly greater than normal and, (d) for pipes more than six diameters long, the head loss may be calculated by using the Darcy law and standard values for the friction coefficient if the pipe is assumed to be 0.7 diameter longer than it actually is. The paper also includes some discussion of the reasons for the experimental observation that the flow is no longer of the boundary layer type downstream of the first ten diameters. Conclusions are also made concerning conditions which will cause the boundary layer to be turbulent effectively from the beginning of the pipe.

Microfilm copy of complete manuscript of 87 pages, \$1.09. Enlargements 6" x 8", 10¢ per page.

## MATHEMATICS

### ASYMPTOTIC PROPERTIES OF IDEAL LINEAR ESTIMATORS

(Publication No. 3716)

Carl Allen Bennett, Ph.D.  
University of Michigan, 1952

The problem studied is the determination of the asymptotic properties of ideal linear estimators of the location and scale parameters of a continuous univariate distribution function. An ideal linear estimator is defined as a linear combination of the order statistics which provides an unbiased estimate of a particular parameter with minimum variance. While the exact determination of such estimators is difficult, due to the necessity for obtaining the exact moments of the order statistics of the distribution being studied, their asymptotic properties can be studied by using known results concerning the asymptotic form of the moments of the order statistics.

It is shown that if the probability density function of a random variable  $X$  is continuous and non-vanishing over the range of possible values of  $X$ , then the ideal linear estimators of the location and scale parameters based on all the order statistics are asymptotically efficient. The limiting form of the coefficients of the estimators is given as a function

defined over the range of  $X$ . The final results are obtained in a sufficiently general form so that the use of truncated samples can be considered. The effect of such truncation on the asymptotic efficiency of the estimates, and the asymptotic form of the coefficients, is studied. Certain situations in which the probability density function is discontinuous, and the estimators "super-efficient," are dealt with as limiting cases of a truncated sample. Under certain restrictions, the distributions for which the asymptotic forms of the coefficients are constant is determined. By applying these results to specific distributions, certain known asymptotic results are obtained, and asymptotic results are compared to available exact results. An application to numerical data is considered.

Two appendices deal with the development of a series for the computation of exact moments for the order statistics of a Cauchy distribution, and with improved asymptotic expected values for finite samples.

Microfilm copy of complete manuscript of 136 pages, \$1.70. Enlargements 6" x 8", 10¢ per page.

### TRANSFINITE TYPE THEORY

(Publication No. 2925)

Enrique Bustamante-Llaca, Ph.D.  
Princeton University, 1944

The logistic system developed here is based on a model consisting of types running into the transfinite (up to the type  $\omega + 1$ , as an example) in which the lowest type consists of the null set only and each new type is formed by adjoining to the preceding type all its subsets, or in the case of transfinite types of the second kind, by taking the union of all preceding types. The resulting system exhibits a relationship to the Zermelo set theory and also to the ordinary type theory.

The logistic system is developed in detail in various directions including theorems exhibiting the elementary structure of the model (and of any other model satisfying the axioms), arithmetic, and definition by recursion.

This paper may be considered as opening a road into the unexplored field of transfinite types by a method due to Prof. Church.

Microfilm copy of complete manuscript of 57 pages, \$1.00. Enlargements 6" x 8", 10¢ per page.

# ON HOMOGENEOUS MEASURES AND OPERATOR DECOMPOSITIONS OF HILBERT SPACE

(Publication No. 3735)

Joshua Chover, Ph.D.  
University of Michigan, 1952

The present paper studies several topics in measure theory and Hilbert space theory which together lead to a concept of generalized eigenvector expansion applicable to various self-adjoint operators acting on not necessarily separable Hilbert space and with possibly continuously distributed eigenvalues.

The work was originally motivated by an examination of the linear expansions used in Dirac's "generalized Hilbert space" model for quantum mechanics, and an attempt to treat them rigorously, still keeping the state space large enough to include the eigenvectors of various physically important operators. Several of the concepts which arose during the subsequent investigation have proved to be of independent interest, and introductory developments of them for their own sake are here presented.

The notion of generalized expansion is roughly as follows: the eigenvectors of a self-adjoint operator are said to be generalized complete if there is a unique decomposition of the space into a direct sum of subspaces each of which is an integral (in the sense of von Neumann) of the eigenspaces of the given operator, with respect to a certain "homogeneous" measure. Existence and uniqueness theorems are given for the decomposition involved and for more general decompositions.

The basic procedure is to consider the set of measures induced by the action, upon each element of the space, of the given self adjoint-operator — the "weighted spectrum". The decomposition of the base space then corresponds to a decomposition of the set of measures into "subspaces" of measures, where each such "subspace" is "absolutely continuous" with respect to an associated homogeneous measure, and the various homogeneous measures are mutually orthogonal.

The homogeneity condition on a measure is a weakening of the translation invariance of Haar measures which permits "holes" in the distribution of mass of the measure. It functions partly to preserve the uniqueness of the probability amplitudes assigned to the vectors by the decomposition of the Hilbert space. The sorting of measures into "subspaces" is accomplished by an abstract equivalence relation which is introduced for collections of measures. This equivalence relation, the homogeneity condition, and a closely related concept of "algebraic support" (carrying the mass of a measure) are among the topics discussed per se.

Microfilm copy of complete manuscript of 171 pages, \$2.14. Enlargements 6" x 8", 10¢ per page.

# BLOCK IDEALS AND ARITHMETICS OF ALGEBRAS

(Publication No. 3772)

William Elliott Jenner, Ph.D.  
University of Michigan, 1952

Most investigations on arithmetics of algebras up to the present time have been concerned exclusively with maximal orders (cf. Deuring - *Algebren*, Berlin 1935). One of the first writers to discuss non-maximal orders seems to have been Fitting (*Math. Ann.* 111, 1935, 19-41). The principal reason for studying such orders is that the natural order in a group algebra, consisting of the ring of all integral linear combinations of canonical basis elements, is always non-maximal for groups of order  $> 1$ . It has been shown by R. Brauer (*Proc. Nat. Acad. Sci.* 30, 1944, 109-114) that certain questions concerning modular representations of the group can be formulated as arithmetical questions in this natural order. The following are the main results of the present investigation.

Let  $A$  be a finite-dimensional algebra with unit element over a field  $K$  where  $K$  is the quotient field of a proper subring  $\sigma$  and the classical ideal theory holds for  $K$ . Subrings  $\mathcal{O}$  of  $A$  which contain the unit element, a  $K$ -basis of  $A$ , and which are finitely-generated  $\sigma$ -modules, are called orders. If  $A$  contains maximal orders, it must be semisimple; if it is semisimple and separable, then it contains maximal orders. Every integral ideal of  $\mathcal{O}$  can be expressed uniquely as a direct intersection of block ideals, i.e. ideals which cannot be expressed as a direct intersection of other ideals. Each prime ideal divisor of a given ideal  $\mathfrak{a}$  must divide exactly one of its block ideal components. Two criteria are given for two such prime ideals to divide the same block ideal. In particular, two prime ideal divisors of  $\mathfrak{a}$  divide the same block ideal if and only if they can be connected by a chain of prime ideal divisors of  $\mathfrak{a}$  such that two adjacent members of the chain do not commute modulo  $\sigma$ . This much of the theory is valid for arbitrary rings with unit element, provided the minimum condition holds for  $\mathcal{O} - \sigma$ .

If  $\mathcal{O}$  is any order, then the block ideal components of ideals  $\mathfrak{a} \subseteq \mathcal{O}$ , where  $\mathfrak{a}$  is a non-zero integral  $\sigma$ -ideal, generate a multiplicative abelian group. The prime ideal decomposition theorem for maximal orders is obtained by new methods. For an order contained in a maximal order, preliminary results are obtained relating the conductor to the discriminants of the two orders.

Microfilm copy of complete manuscript of 60 pages, \$1.00. Enlargements 6" x 8", 10¢ per page.



CONTRIBUTIONS TO THE THEORY  
OF GAMES AND  
STATISTICAL DECISION FUNCTIONS

(Publication No. 3899)

Jack Carl Kiefer, Ph.D.  
Columbia University, 1952

The theory of statistical decision functions was formulated by A. Wald in numerous publications starting with "Contributions to the Theory of Statistical Estimation and Testing Hypotheses", *Annals of Math. Stat.*, 10 (1939); and it was developed extensively by himself and others in recent years in such works as his *Statistical Decision Functions*, John Wiley and Sons, 1950. The present work is devoted to research in or connected with this theory, and is divided into three separate parts, each of which may be read independently of the others.

Chapter 2 considers certain topics in the theory of zero-sum two-person games; this theory, aside from its importance in other applications, is of great use in the theory of statistical decision functions because for many considerations the latter theory may be treated as a special case of the former. The first part of Chapter 2 considers the relations between various weak conditions on spaces of strategies. These conditions are used subsequently in the chapter to prove theorems on determinateness of the game, existence of minimax strategies, and complete classes of strategies, under weaker restrictions than have been imposed heretofore (e.g., the payoff function need not be bounded, and several other conditions are weakened in particular theorems). At the same time, the relationship between the conditions used herein and those used in previous works is made clear, and certain errors in the latter are pointed out. Numerous examples are given in connection with various game-theoretic phenomena which are studied in detail.

In Chapter 3 a detailed exposition is given of the theory of statistical decision functions in the case when the cost of taking each observation is the same and the successive chance variables form a stationary process. This chapter thus constitutes a generalization of the work of A. Wald and J. Wolfowitz, "Bayes Solutions of Sequential Decision Problems", *Annals of Math. Stat.*, 21 (1950), or Chapter 4 of *Statistical Decision Functions*; and the development proceeds parallel to that of the latter works as far as possible. The study and the characterization of Bayes solutions are simplified by carrying them out for non-randomized decision functions and then using the result of A. Wald and J. Wolfowitz, "Two Methods of Randomization in Statistics and the Theory of Games", *Annals of Math.*, 53 (1951), to extend these results to the class of randomized decision functions, as well. The differences between the case studied herein and that studied previously in the works mentioned above, are pointed out. For example, if the setup is that of testing a simple hypothesis sequentially against a simple alternative, it is shown that the analogues in the present case to various properties of the sequential probability ratio test in the

previously studied case (see, e.g., A. Wald and J. Wolfowitz, "Optimum Character of the Sequential Probability Ratio Test," *Annals of Math. Stat.*, 19 (1948)), are no longer valid. Characterizations of Bayes solutions (and thus, of complete classes) are given for this (hypothesis-testing) and other setups.

Chapter 4 is concerned with a specific statistical decision problem: namely, that of minimax sequential point estimation of the range of a rectangular distribution with unknown range when the cost of taking each observation is the same, and when the weight function is one which does not seem unreasonable for many applications. It is shown that there is a fixed sample procedure which is minimax.

Microfilm copy of complete manuscript of 215 pages, \$2.69. Enlargements 6" x 8", 10¢ per page.

NEW METRIC PROPERTIES  
OF SPHERICAL AND  
ELLIPTIC SPACES

(Publication No. 3859)

William Lee Stamey, Ph.D.  
University of Missouri, 1952

A semimetric space  $S$  is pseudo  $S_{n,r}$  provided each of its  $(n+2)$ -tuples is congruent with a subset of the convexly metrized  $n$ -sphere  $S_{n,r}$  of diameter  $\pi r$ , but  $S$  itself is not. If no two points of a pseudo  $S_{n,r}$  set  $S$  have distance  $\pi r$ , it was shown by Blumenthal and Thurman (*American Journal of Mathematics*, vol. 62, 1940, pp. 835-854) that for every integer  $k$ , the matrix  $(\cos(p_i p_j / r))$ ,  $i, j, 1, \dots, k$ , of each  $k$ -tuple  $p_1, \dots, p_k$  of points of  $S$  has (upon multiplication by  $-1$  of appropriate rows and same numbered columns) every element equal to 1 or  $-1/(n+1)$ , provided  $S$  contains more than  $n+3$  points. This thesis completes the characterization by showing that the restriction that  $S$  be without diametral point-pairs may be dropped. The Blumenthal-Thurman theorem remains valid provided  $S$  contains more than  $2(n+3)$  points, or if  $S$  contains  $n+k+3$  points ( $0 < k \leq n+3$ ), provided  $S$  contains at most  $k-1$  diametral point pairs.

Other metric properties of the  $S_{n,r}$  are obtained by considering spaces called "almost  $S_{n,r}$ ". These are spaces of power greater than  $n+2$  and having the property that exactly one  $(n+2)$ -tuple is not imbeddable in  $S_{n,r}$ . A metric characterization of almost  $S_{n,r}$  spaces, not containing diametral point-pairs, is obtained. This leads to a spherical analogue of a theorem proved independently by Blumenthal (*Bulletin of the American Mathematical Society*, vol. 49, 1943, pp. 321-338) and by Pepper and Topel (*Reports of a Mathematical Colloquium, University of Notre Dame, Second Series Issue 3*, pp. 34-36) for the  $n$ -dimensional euclidean space.

Defining a "free  $(n+2)$ -tuple" of a semimetric space  $S$  as one which is neither known nor assumed to be congruently imbeddable in the  $S_{n,r}$ , it is shown that if a semimetric  $(n+k+4)$ -tuple ( $k \geq 0$ ) without diametral points has at most  $k$  free  $(n+2)$ -tuples,

and if its remaining  $(n + 2)$ -tuples are imbeddable in the  $S_{n,r}$ , then each of its  $(n - 2)$ -tuples is imbeddable in  $S_{n,r}$ . Hence, such spaces are either themselves congruently imbeddable in  $S_{n,r}$  or are pseudo  $S_{n,r}$ .

All of these imbedding theorems lead naturally to corresponding theorems in the theory of symmetric determinants and the statements of these determinant theorems are given along with the geometric theorems.

Just as geometric theorems on imbeddability of arbitrary semimetric spaces lead to determinant theorems, a study of certain symmetric matrices and their determinants leads to theorems on imbeddability. This is done in the final section of the thesis where the problem of superposability of quadruples of points in the elliptic plane is investigated.

Two subsets  $A$  and  $B$  of a semimetric space  $S$  are said to be superposable provided there exists a congruence  $f(S) = S$  of  $S$  onto itself such that  $f(A) = B$ . In euclidean, spherical, and hyperbolic spaces, the notions of congruence and superposability are logically equivalent, but this is not true in elliptic spaces of dimension greater than one. This has been one of the principal obstacles in attempts to solve imbeddability problems for such spaces.

Blumenthal (Transactions of the American Mathematical Society, vol. 59, 1947, pp. 431-451) has shown that if three triples of points of an elliptic space are pairwise congruent, then at least two of these triples are superposable. Using determinant criteria for imbeddability of arbitrary spaces in the elliptic plane and for superposability of subsets of the elliptic plane, it is shown (using algebraic arguments almost exclusively) that if five quadruples of points of the elliptic plane are mutually congruent, then some two of them are superposable. In addition there are given necessary conditions in order that four mutually congruent quadruples of the elliptic plane may fail to contain a superposable pair of quadruples.

Microfilm copy of complete manuscript of 53 pages, \$1.00. Enlargements 6" x 8", 10¢ per page.

#### CERTAIN APPLICATIONS OF IRREDUCIBILITY TO CONNECTED HAUSDORFF SPACES

(Publication No. 3933)

David D. Strebe, Ph.D.  
University of Buffalo, 1952

Certain problems associated with the concept of irreducibility as applied to connected Hausdorff spaces have been considered. Spaces which are irreducibly connected or irreducibly closed and connected about arbitrary subsets have been investigated.

With regard to irreducibly connected spaces, a study has been made of the existence, the uniqueness, and the nature of subsets about which any given connected space is irreducibly connected. The nature of connected spaces which are irreducibly connected

about irreducible subsets (basic sets) has been investigated, and previously known results have been amplified. If  $M$  is a connected space which has a basic set consisting of  $n$  points, where  $n$  is a positive integer greater than 1, a decomposition of  $M$  into a sum of  $n-1$  or less subsets, each of which is irreducibly connected about 2 points, has been obtained. Separable metric spaces which have basic sets consisting of a countable number of points have been studied. It has been found that restricting the basic set of such a space in this manner provides considerable information concerning the nature of the space.

A systematic study of spaces which are irreducibly closed and connected about arbitrary subsets has been provided, since the literature to date contains little information about such spaces, except for the special case of spaces which are irreducibly closed and connected about two points. The nature, the existence, and conditions for uniqueness of subsets about which a given connected space is irreducibly closed and connected have been established. Irreducible subsets (basic sets) about which connected spaces are closed and connected have been investigated. The nature of the basic set has been determined, and problems associated with the existence and uniqueness of such sets have been considered.

If  $A$  is any subset of a given connected space  $S$ , the question of the existence in  $S$  of a sub-space  $M$  which is irreducibly connected or irreducibly closed and connected about  $A$  has been considered. It has been found that the existence of  $M$  may depend upon the nature of the space  $S$ , upon the nature of the set  $A$ , or upon both  $S$  and  $A$ .

A comparison between the subsets about which a given connected space is irreducibly connected, and those about which the space is irreducibly closed and connected has been made. Informative differences and relationships have been established, in particular with regard to the basic sets of such spaces.

Microfilm copy of complete manuscript of 110 pages, \$1.38. Enlargements 6" x 8", 10¢ per page.

#### ON LINEAR DIFFERENTIAL-DIFFERENCE EQUATIONS AND EXPONENTIAL SUMS

(Publication No. 3694)

Hermann V. Waldinger, Ph.D.  
Columbia University, 1951

An investigation of the differential-difference equation with constant coefficients

$$\sum_{j=1}^n \sum_{k=0}^{m_j} A_{jk} \frac{d^k y(z \text{ coj})}{dz^k} = \phi(z) \quad (1)$$

is carried out in this paper. It is assumed that  $\phi(z)$  is of type  $(M, \beta)$ . It is further supposed that  $w_1 = 0$  and that  $w_2, w_3, \dots, w_n$  are contained in the sector  $S(\beta): |\arg z| < \beta \leq \frac{\pi}{2}$ . All solutions of (1) which are of type  $(M, \beta)$ , are then shown to belong to a non-empty finite parameter family of functions. (The statement



$\phi(z)$  is of type  $(M, \beta)$  means that  $\phi(z)$  is analytic at  $z = 0$  and in the sector  $S(\beta)$ , and that for every pair of positive numbers  $\epsilon, \delta$  one can find a number  $C_0(\epsilon, \delta)$ , such that  $|\phi(z)| < C_0(\epsilon, \delta) e^{(M+\epsilon)|z|} \dots (2)$ , the given number  $M$  being positive). A discussion of the exponential sum

$$Y(z) = \sum_{j=1}^n \sum_{k=0}^{m_j} A_{jk} z^k e^{w_j z} \quad (3)$$

and its reciprocal  $F(z)$  is presented here. It is necessary for finding the family of solutions of (1).

It is shown that this family consists of all functions of the form  $y_0(z) + H(z) \dots (4)$ , where  $y_0(z)$  is of type  $(M, \beta)$  and is a particular solution of (1), and where

$$H(z) = \sum_{s=1}^p \left( \sum_{j=1}^{j_s-1} C_{sj} z^j e^{\zeta_s z} \right) \quad (5)$$

the  $C_{sj}$ 's are here any complex constants; each  $\zeta_s$  is one of the  $p$  distinct zeros of multiplicity  $j_s$  of  $\Psi(z)$  contained in the set  $\eta(M, \beta)$ . (The point  $\zeta$  belongs to  $\eta(M, \beta)$ , if  $R[\zeta z] \leq M|z|$  for every  $z$  in  $S(\beta)$ ). The proof of the main result of this paper is divided into the following two steps:

1.  $y_0(z)$  is found by a formal process. Let the large positive number  $b$  be chosen. Let  $q = 1 - \frac{1}{b}$ . We define  $u(z)$  as  $\frac{qz-1}{q-1}$ .

We obtain the approximating equation

$$\sum_{j=1}^n \sum_{k=0}^{m_j} A_{jk} \frac{d^k Y(z+w_j)}{dz^k} = \phi(u(z)) \quad (6)$$

by replacing  $\phi(z)$  in (1) by  $\phi(u(z))$ . But  $\phi(z)$  is analytic at  $b$ , one thus has the expansion

$$\phi(u(z)) = \sum_{n=0}^{\infty} \phi_n q^{nz}.$$

One, therefore, seeks a solution of the form

$$Y(z) = \sum_{n=0}^{\infty} c_n q^{nz} \quad (7)$$

Substitution leads to the formal solution

$$Y(z) = \sum_{n=0}^{\infty} \frac{\phi_n q^{nz}}{\Psi(n \log q)} \quad (8)$$

Replacing  $\frac{1}{\Psi}$  by its Mittag-Leffler expansion one finds an expansion of  $Y(z)$  as an infinite series of functions. Taking the formal limit as  $b \rightarrow \infty$ , that is as  $u(z) \rightarrow z$ , one obtains  $y_0(z)$ . This function is given as a series of contour integrals, each term involving  $\phi(z)$  and a finite sum of principal parts of  $F(z)$ .

Straightforward calculations, making use of the techniques of the calculus of residues, show that  $y_0(z)$  is indeed a solution of (1) of type  $(M, \beta)$ .

2. Having obtained  $y_0(z)$ , it is evident that all solutions of (1) which are of type  $(M, \beta)$ , must be of

the form  $y_0(z) + \psi(z)$ ; where  $\psi(z)$  is of type  $(M, \beta)$  and satisfies the homogeneous equation

$$\sum_{j=1}^n \sum_{k=0}^{m_j} A_{jk} \frac{d^k \psi(z+w_j)}{dz^k} = 0 \quad (9)$$

It is shown that  $\psi(z) = H(z) \dots (10)$  as follows: The Laplace transform  $T(\sigma)$  is calculated for the left member of (9), the Laplace integral being taken along a half-line  $\arg z = \beta$ , in  $S(\beta)$ . Straightforward calculation yields  $T(\sigma) = Y(\sigma) \mathcal{L}(V(z)) + B(\sigma) = 0$ , or  $\mathcal{L}(V(z)) = -B(\sigma)/Y(\sigma) \dots (11)$ , where  $B(\sigma)$  is a simple integral function. Inverting the Laplace-transform  $\mathcal{L}(V(z))$  one finds that

$$V(z) = -\frac{1}{2\pi i} \int_{c\beta_1} \frac{B(\sigma)}{Y(\sigma)} e^{\sigma z} d\sigma \quad (12)$$

where  $c\beta_1$  is a line perpendicular to the line  $\arg z = -\beta_1$ . Let  $H_{\beta_1}$  be the half plane to the left of  $c\beta_1$ . Using the techniques of the calculus of residues, one obtains a representation

$$V(z) = E(z, \beta_1) = \sum_{\zeta_s \in H_{\beta_1}} \left( \sum_{j=1}^{j_s-1} C_{sj} z^j e^{\zeta_s z} \right) \quad (13)$$

where  $\sum_{j=1}^{j_s-1} C_{sj} z^j e^{\zeta_s z}$  is the residue of the function  $-\frac{B(\sigma)}{Y(\sigma)} e^{\sigma z}$  at the zero  $\zeta_s$ .

If  $\beta_2$  is near  $\beta_1$  one has a second representation  $V(z) = E(z, \beta_2)$ . Comparing these representations one finds that every non-vanishing residue involved in either representation must be in the intersection  $H_{\beta_1} \cap H_{\beta_2}$ . This procedure being available for all but certain exceptional  $(\beta_1, \beta_2)$ , one concludes that  $V(z)$  can involve only finitely many exponents, namely the ones contained in  $\eta(M, \beta)$ .

Microfilm copy of complete manuscript of 31 pages, \$1.00. Enlargements 6" x 8", 10¢ per page.

#### A CHARACTERIZATION OF CERTAIN TOPOLOGICAL SPACES BY MEANS OF THEIR GROUPS OF HOMEOMORPHISMS

(Publication No. 3815)

Martin T. Wechsler, Ph.D.  
University of Michigan, 1952

This thesis is a study of the groups of homeomorphisms of topological spaces under the point-open topology. The main aspect of the study is that of characterization; that is, in what sense, if in any, does the homeomorphism group in the point-open topology characterize the space. In addition, some progress is made toward an understanding of the topological and algebraic structure of the homeomorphism groups of some spaces and the relation of

that structure to the topological structure of the space.

Regarding the characterization problem, it is shown that, although many spaces are not characterized by their groups of homeomorphisms, there is a considerable class of spaces (this class is called  $F$ ) among which the homeomorphism group is characterizing. The most important distinguishing property of these spaces is a very high degree of homogeneity. Among these spaces are found all the manifolds of dimension two or greater. The chief task in the present treatment of the problem is that of picking out of the homeomorphism group the sub-group consisting of all those homeomorphisms which leave some given point fixed. The technique developed for doing this rests heavily on the concept of the orbit of a sub-group in the  $n$ -fold Cartesian product of the ground space with itself. The above material is treated in parts I and II.

Part III of this work develops a few of the properties of homeomorphism groups in the point-open topology, making some use of the results of parts I and II. The question of what subgroups of the group of all homeomorphisms may characterize a space is settled, and a start is made in determining which group-spaces may occur as characterizing groups of homeomorphisms. The earlier work is used to prove that every automorphism of the group of homeomorphisms of a space in the family  $F$  is an inner automorphism. Consideration is given to the homeomorphism groups of some special spaces, in the course of which it is proved that the groups of the line and the circle are disconnected. A cross-section function is exhibited for those groups which operate on manifolds, and it is shown that these groups are fibre-bundles over the manifold in the sense of Ehresmann and Feldbau. Lastly, the fact that the group of homeomorphisms of a space in  $F$  cannot contain a closed, non-trivial, normal subgroup is established.

Microfilm copy of complete manuscript of 59 pages, \$1.00. Enlargements 6" x 8", 10¢ per page.

## PHYSICS

### THE EFFECT OF THE GENERAL MIXED BETA INTERACTION ON THE SHAPE OF FORBIDDEN BETA-SPECTRA AND ON THE BETA ANGULAR DISTRIBUTIONS FUNCTIONS

(Publication No. 3709)

Mohammed Kashif Al-Ghita, Ph.D.  
University of Michigan, 1951

In the present theory of beta radioactivity, consideration is usually restricted to one of the five possible interactions which couple the transition of a neutron into a proton inside the nucleus to the emission of an electron and neutrino. These five

interactions (the so-called scalar, vector, tensor, axial vector pseudo-scalar interactions) are selected for reasons of simplicity but there is no a priori reason to exclude linear combinations of these interactions, and there are indications that the experimental material will require such combinations; therefore, the shape of the first-and second-forbidden beta spectra and the beta angular distribution function for the general linear combination of the five interactions have been calculated. Since for each of these interactions the corresponding results were already computed, the effects of the cross terms have been especially considered.

In Chapter II of the thesis the method is presented for the calculation of the "cross" correction factors to the so-called allowed shape for first-and second-forbidden beta spectra. In Chapter III the results are tabulated first for the nuclear charge  $Z = 0$ , and then for the actual case of  $Z \neq 0$ . In the two cases the method of calculation is different, so they provide a check for the calculations.

In Chapter IV and V the method and results are given for the beta angular distribution. It is shown that for allowed transitions the angular distribution is always isotropic. For first-forbidden transitions the results have been obtained for all possible cross terms between interactions and for all possible combinations of nuclear matrix elements. For second-forbidden transitions the results have been obtained for all possible cross-terms between interactions but only for those combinations of nuclear matrix elements, in which the two matrix elements, have the same tensorial character (case of quasi-interference). The results are tabulated in Tables 17, 18 and 19 of the thesis. By integrating over the angles one must obtain again the first-and second-forbidden beta spectra, and this provides a check on the calculations.

Because of the absence of relevant experimental data no discussion of the results has been attempted.

Microfilm copy of complete manuscript of 115 pages, \$1.44. Enlargements 6" x 8", 10¢ per page.

### PRODUCTION OF CHARGED $\pi$ MESONS IN H, D, C, AND Pb BY 381 Mev PROTONS

(Publication No. 3875)

Martin Moses Block, Ph.D.  
and Sidney Passman  
Columbia University, 1952

The differential cross-section for the production of charged  $\pi$  mesons at  $90^\circ$  from a 381 Mev proton beam has been measured in H, D, C, and Pb. The meson detectors were nuclear emulsions, imbedded in a tapered copper absorber, which were placed  $90^\circ$  below the internal circulating proton beam of the Nevis cyclotron. Mesons of both signs, from 0 to 125 Mev are recorded in a single emulsion. The beam was monitored by means of the  $C^{11}$  activity produced in the target; the absolute activity, combined with the cross-section for the production of  $C^{11}$ , allows a determination of the absolute cross-section.



The hydrogen and deuterium results were obtained by subtracting the carbon cross-section from polyethylene and deuterated paraffin, respectively. Assuming the reaction in H is  $p + p \rightarrow \pi^+ + d$ , the total cross-section for H at 381 Mev is calculated from the  $90^\circ$  value. Comparison with the 345 Mev value at Berkeley indicates that the matrix element is energy-dependent. The spectra for heavy nuclei are calculated with the assumptions that meson production occurs through nucleon-nucleon collisions, and that the meson receives the maximum available energy in the c-m system. The calculations utilizing energy dependent-matrix elements agree with the experimental  $\pi^+$  data at both 345 and 381 Mev. The  $\pi^-$  data do not agree. Comparison of experimental results at 345 and 381 Mev indicate an essential difference in the behaviour of  $\pi^+$  and  $\pi^-$  mesons, both as a function of bombarding proton energy and target atomic weight. High  $\pi^+/\pi^-$  ratios are observed at 381 Mev, being  $\sim 25$  for D, 10 for C, and 5 for Pb. A calculation similar to that carried out for the heavy elements was made for D, and it predicted a significantly lower deuterium-to-hydrogen cross-section ratio than the observed value.

Microfilm copy of complete manuscript of 116 pages, \$1.45. Enlargements 6" x 8", 10¢ per page.

**A STUDY OF THE BETA RAY SPECTRA OF CERTAIN ARTIFICIALLY PRODUCED RADIOACTIVE ELEMENTS WITH A LENS TYPE SPECTROMETER**

(Publication No. 3722)

George Edgar Bradley, Ph.D.  
University of Michigan, 1952

The purpose of this study was to measure the energy distribution of the beta particles emitted from certain artificially produced radioactive elements and to apply the information so obtained to establish the decay schemes of these elements, as well as the type of beta interaction.

A lens type beta spectrometer, having a chamber forty-five inches in length and seven inches in diameter, was built. The chamber and focusing coils were mounted parallel to the earth's magnetic field to prevent defocusing. Current in the toroidal coil was supplied by storage batteries. Calibration was made on the cesium<sup>137</sup> K conversion line (.6238 Mev.) and the line shape measured for various baffle positions. The investigations were carried out at a resolution of 2.5%.

The spectra of the pile produced elements; Cs<sup>137</sup>, Cs<sup>134</sup>, Br<sup>82</sup>, I<sup>131</sup>, P<sup>32</sup> and cyclotron produced Na<sup>22</sup> were measured. The lower energy branch of the Cs<sup>137</sup> spectrum gave a spectral shape corresponding to a first forbidden tensor interaction, while Cs<sup>134</sup>, Br<sup>82</sup>, I<sup>131</sup>, Na<sup>22</sup> all yielded allowed spectral shapes. The energies of the end points of these spectra were measured as well as the energy of the conversion lines. On the basis of this information and previously

reported data, decay schemes and level assignments of the spin were suggested.

A carrier-free sample of P<sup>32</sup> yielded a spectrum which showed a 250 Kev. beta activity which decayed more slowly than the fourteen day P<sup>32</sup>. Five different samples of P<sup>32</sup> obtained from Oak Ridge were investigated and on the basis of relative strengths of the activities, a twenty day half-life was assigned to the low energy component. It appears that this 250 Kev. beta spectrum is to be associated with the activity recently assigned to P<sup>33</sup> by Sheline, Holtzman and Fan.

The first steps for the conversion of the instrument to a coincidence spectrometer were made. A scintillation beta detector using an anthracene phosphor and a RCA 5819 photo-multiplier was installed and found to have a 100% efficiency for beta particles with energies as low as 90Kev. A description of the scintillation counters and the coincidence circuits is included in the thesis.

Microfilm copy of complete manuscript of 98 pages, \$1.23. Enlargements 6" x 8", 10¢ per page.

**MAGNETIC HYPERFINE STRUCTURE IN DIATOMIC MOLECULES**

(Publication No. 3883)

Robert Alan Frosch, Ph.D.  
Columbia University, 1952

After a discussion of the theory of magnetic hyperfine structure in atoms, and a discussion of molecular structure, the magnetic hyperfine structure of a diatomic molecule containing one non-zero nuclear spin is derived from a molecular Hamiltonian in which the electron is treated using the two component "Pauli approximation" to the Dirac equation. The various coupling cases and simple representations of a one electron model are discussed. The terms of the hyperfine structure Hamiltonian, both diagonal in  $\Lambda$  and off-diagonal in  $\Lambda$ , are given in each case as functions of the angular momenta. These terms contain the effects of both the "s" and "non-s" terms in the electronic wave function. The coefficients of the angular momentum terms are given explicitly as averages over functions of the electron coordinates and the internal electric field of the molecule. Matrix elements of the various functions of angular momenta appearing in the hyperfine structure Hamiltonian in the various zero field representations are given. The effect of  $\Lambda$  doubling on these matrices is discussed. Formulas for intensity rules for electric and magnetic dipole radiation are given, as well as selection rules. Several second order effects in  $^1\Sigma$  molecules are discussed. Diatomic molecules containing two nuclei with non-zero nuclear spins are discussed. Several such cases may be solved using modifications of the formulas for molecules containing only one non-zero nuclear spin. The magnetic hyperfine structures of three examples are discussed. Formulas are given for the positions

of hyperfine structure components of several  $4K = 0$ ,  $4J = \pm 1$  transitions in the  $^3\Sigma$  ground state of  $O_{16}O_{17}$ .

Microfilm copy of complete manuscript of 92 pages, \$1.15. Enlargements 6" x 8", 10¢ per page.

# A CLOUD-CHAMBER INVESTIGATION OF THE MULTIPLE SCATTERING OF LOW-ENERGY PROTONS IN GASES

(Publication No. 3930)

Eugene Henry Gerber, Ph.D.  
University of Buffalo, 1952

An experimental investigation of the phenomenon of multiple scattering is reported. It was undertaken to determine the validity of the theory as formulated by Rossi and Greisen, H.A. Bethe, and W.T. Scott. To do this, low-energy protons resulting from the reaction  $_{13}Al^{27}(\alpha, p)_{14}Si^{30}$  were observed in a six-inch cloud chamber filled with air, argon or helium. Measurements were made on the last five centimeters of all measurable tracks ending in the cloud chamber. The proton energy at the half range was determined from the range-energy curves. The radius of curvature  $\rho$  was obtained by matching circles to the track. For a C-type track,  $\rho$  was measured if it was less than 150 cm; if  $\rho$  was greater than 150 cm, the track was called an O-track (zero curvature) and recorded as such. S-tracks also were only tabulated. Histograms of the observed number of tracks in a given interval of radius of curvature are shown for tracks in air and in argon.

In order to compare the experimental data with the theory a mean square curvature was calculated. As no measurements were made on S-tracks, they were not included in this calculation. This is in keeping with W.T. Scott's result that the distribution of curvature is not narrowed by considering only symmetrical tracks. In this calculation, if the number of tracks was taken as all of the C- and O-type tracks, a large error could occur, as it is difficult to determine whether a track is of the O- or S-type. This difficulty is avoided by assuming, as predicted by the theory, that the distribution of curvatures should be Gaussian. It is then only necessary to know the mean square curvature  $\langle c^{12} \rangle_{AV}$  of the  $N^1$  tracks with a radius of curvature less than some arbitrary  $\rho^1$ . The total number  $N$  of all C-tracks and their mean square curvature  $\langle c^2 \rangle_{AV}$  can then be calculated from  $N^1$  and  $\langle c^{12} \rangle_{AV}$ . Taking  $\rho^1$  as 100 cm, a  $\langle c^2 \rangle_{AV}$  and  $N$  were calculated from the experimental data, these were then used to normalize a distribution in  $\rho$ , obtained by changing variables in the Gaussian distribution in curvature. The agreement between this distribution in  $\rho$  and the histograms is good, if it is remembered that the experimental results have attached to them two errors, one due to statistics, of approximately the square root of the number of tracks, and one due to

matching of circles, which in each individual measurement can be of the order of 5 cm for the small radii and 10 cm for the larger ones. This agreement is interpreted as an experimental confirmation of the fact that the distribution is Gaussian. This fact established, the experimental  $\langle c^2 \rangle_{AV}$  was compared with the theoretical result, which was obtained by using Bethe's results modified slightly by the use of Rossi and Greisen's definition of  $\theta_{min}$ , the minimum angle of scattering. Here again the agreement was good. The last quantity checked was the experimental value of  $N$ ; it agreed with the predictions of W.T. Scott, that is, it was equal to 58% of the total number of tracks. The above results apply only to air and argon. The data obtained for helium are only sufficient to permit a qualitative statement that the scattering curvatures were smaller than those for air and argon.

All of the main points of the theory agreed with the experimental results within the limits of the experimental error. Finer points of the theory such as the value of the minimum angle of scattering could not be checked as the difference between the different theories is less than the error of these experiments.

Microfilm copy of complete manuscript of 68 pages, \$1.00. Enlargements 6" x 8", 10¢ per page.

# ISOTOPIC MASSES OF PALLADIUM, CADMIUM, INDIUM, TIN, TELLURIUM, IODINE, AND XENON

(Publication No. 3636)

Richard Emerson Halsted, Ph.D.  
University of Minnesota, 1952

The double focusing mass spectrometer developed by Dr. A.O.C. Nier at the University of Minnesota has been used to measure 42 atomic masses in the region from palladium through xenon. When supplemented by nuclear reaction energies, the data give the masses of 74 nuclides between mass numbers 102 and 136. Since the binding energies which can be derived from these masses must be explained by any satisfactory theory of nuclear forces, a profitable comparison of experimental results with the predictions of existing theory can be made. The Wigner semi-empirical mass formula is most suitable in this application. A fit of this formula to the data confirms the existence of the "magic number" 50 protons and indicates an inability of the formula to account for the binding energy variations between isobaric nuclei. An empirical modification of the formula is found to correct for the latter effect. The doublets measured, and the mass defects (mass - mass number) derived for the heavy nuclei by using 1.008146 and 12.003842 for the hydrogen and carbon masses respectively, are:



Doublet	$\Delta M$ ( $10^{-4}$ amu)	Mass defects ( $10^{-4}$ amu, all negative)	Doublet	$\Delta M$ ( $10^{-4}$ amu)	Mass defects ( $10^{-4}$ amu, all negative)
$C_4H_3 - Pd^{102}/2$	$710.6 \pm 0.4$	$625.0 \pm 0.9$	$C_5H_5 - Te^{130}/2$	$856.7 \pm 0.4$	$514.7 \pm 1.0$
$C_4H_4 - Pd^{104}/2$	$796.8 \pm 0.5$	$634.5 \pm 1.1$	$C_{10}H_7 - I^{127}$	$1501.6 \pm 1.2$	$547.2 \pm 1.3$
$C_8H_9 - Pd^{105}$	$1656.5 \pm 1.4$	$616.0 \pm 1.5$	$C_5H_2 - Xe^{124}/2$	$626.1 \pm 0.3$	$542.2 \pm 0.7$
$C_4H_5 - Pd^{106}/2$	$878.3 \pm 0.9$	$634.7 \pm 1.8$	$C_5H_3 - Xe^{126}/2$	$712.7 \pm 0.7$	$552.4 \pm 1.4$
$C_8H_{10} - Pd^{106}$	$1751.1 \pm 1.8$	$629.1 \pm 1.8$	$C_{10}H_8 - Xe^{128}$	$1591.3 \pm 0.7$	$555.4 \pm 0.9$
Weighted Average for $Pd^{106}$		$632.0 \pm 1.9$	$C_3H_7 - Xe^{129}/3$	$865.4 \pm 0.4$	$539.9 \pm 1.5$
$C_4H_6 - Pd^{108}/2$	$952.4 \pm 0.5$	$619.9 \pm 1.1$	$C_5H_5 - Xe^{130}/2$	$874.3 \pm 0.4$	$549.9 \pm 1.0$
$C_4H_7 - Pd^{110}/2$	$1025.6 \pm 0.6$	$603.5 \pm 1.3$	$CO_2 - Xe^{131}/3$	$3549.3 \pm 1.4$	$532.7 \pm 4.2$
$C_4H_5 - Cd^{106}/2$	$861.8 \pm 0.7$	$601.6 \pm 1.4$	$C_5H_6 - Xe^{132}/2$	$950.0 \pm 0.6$	$538.2 \pm 1.3$
$C_4H_6 - Cd^{108}/2$	$949.4 \pm 0.5$	$614.0 \pm 1.1$	$CO_2 - Xe^{132}/3$	$218.0 \pm 0.5$	$538.8 \pm 1.4$
$C_4H_7 - Cd^{110}/2$	$1031.0 \pm 0.6$	$614.3 \pm 1.3$	Weighted Average for $Xe^{132}$		$538.5 \pm 1.0$
$C_4H_8 - Cd^{112}/2$	$1109.8 \pm 0.5$	$608.9 \pm 1.2$	$C_5H_7 - Xe^{134}/2$	$1022.2 \pm 0.5$	$519.7 \pm 1.2$
$C_4H_{16} - Cd^{112}$	$2224.3 \pm 0.9$	$613.6 \pm 1.0$	$C_5H_8 - Xe^{136}/2$	$1091.5 \pm 0.4$	$495.4 \pm 1.1$
Weighted Average for $Cd^{112}$		$611.5 \pm 1.7$	Microfilm copy of complete manuscript of 66 pages, \$1.00. Enlargements 6" x 8", 10¢ per page.		
$C_8H_{17} - Cd^{113}$	$2286.1 \pm 0.9$	$593.9 \pm 1.1$			
$C_4H_9 - Cd^{114}/2$	$1186.6 \pm 0.7$	$599.5 \pm 1.5$			
$C_3H_5O - Cd^{114}/2$	$823.0 \pm 0.6$	$600.9 \pm 1.2$	TOTAL CROSS SECTION MEASUREMENTS FOR 85 MEV $\pi^-$ MESONS ON HYDROGEN AND SEVERAL OTHER NUCLEI  (Publication No. 3893)  Peter Judah Isaacs, Ph.D. Columbia University, 1952		
Weighted Average for $Cd^{114}$		$600.3 \pm 0.9$			
$C_3H_6O - Cd^{116}/2$	$893.9 \pm 0.6$	$579.8 \pm 1.2$			
$C_8H_{17} - In^{113}$	$2287.7 \pm 1.0$	$595.5 \pm 1.2$	The total cross-section for the interactions of various nuclei with 85 Mev. $\pi^-$ mesons has been mea- sured using the external meson beam of the Nevis cyclotron. Before these measurements could be per- formed, it was necessary to make a careful analysis of the beam. This was accomplished by using a time- of-flight measurement to separate electrons and pro- tons from mesons, a special mu meson detector to determine the number of mu mesons, and a careful search for low energy particles. These experiments showed that the beam consisted of about 95% $\pi^-$ me- sons and 5% $\mu$ mesons. There was less than 1% elec- trons, protons and low energy particles in the beam.		
$C_9H_7 - In^{115}$	$1512.0 \pm 1.0$	$596.0 \pm 1.1$			
$C_9H_7 - Sn^{115}$	$1514.6 \pm 2.5$	$598.6 \pm 2.5$			
$C_3H_6O - Sn^{116}/2$	$907.8 \pm 0.9$	$607.5 \pm 1.8$	The actual transmission measurements showed that of the elements tested, those heavier than alu- minum were opaque. Those lighter than aluminum were just slightly transparent. The cross-section for the interaction of the proton, however, was small, only 1/5 the geometric cross-section.		
$C_9H_8 - Sn^{116}$	$1604.7 \pm 1.4$	$607.2 \pm 1.5$			
Weighted Average for $Sn^{116}$		$607.3 \pm 1.1$			
$C_9H_9 - Sn^{117}$	$1673.7 \pm 0.9$	$594.8 \pm 1.0$	Microfilm copy of complete manuscript of 47 pages, \$1.00. Enlargements 6" x 8", 10¢ per page.		
$C_3H_7O - Sn^{118}/2$	$986.3 \pm 1.3$	$601.6 \pm 2.6$			
$C_9H_{10} - Sn^{118}$	$1762.9 \pm 1.9$	$602.5 \pm 1.9$			
Weighted Average for $Sn^{118}$		$602.2 \pm 1.6$			
$C_9H_{11} - Sn^{119}$	$1829.7 \pm 1.1$	$587.8 \pm 1.2$			
$C_5 - Sn^{120}/2$	$489.2 \pm 0.7$	$594.1 \pm 1.4$			
$C_5H - Sn^{122}/2$	$561.1 \pm 0.7$	$575.1 \pm 1.5$			
$C_5H_2 - Sn^{124}/2$	$630.5 \pm 0.5$	$551.0 \pm 1.0$			
$C_9H_{12} - Te^{120}$	$1894.5 \pm 1.5$	$571.2 \pm 1.6$			
$C_5H - Te^{122}/2$	$563.9 \pm 0.4$	$580.7 \pm 0.8$			
$Te^{123}/2 - C_5H$	$4444.9 \pm 2.0$	$563.2 \pm 3.9$			
$C_5H_2 - Te^{124}/2$	$641.1 \pm 0.5$	$572.2 \pm 1.1$			
$Te^{125}/2 - C_5H_2$	$4368.0 \pm 1.6$	$554.0 \pm 3.1$			
$C_5H_3 - Te^{126}/2$	$715.6 \pm 0.3$	$558.0 \pm 0.7$			
$C_{10}H_8 - Te^{128}$	$1570.9 \pm 1.2$	$535.1 \pm 1.3$			

# THE METHYL ALCOHOL MOLECULE AND ITS MICROWAVE SPECTRUM

(Publication No. 3770)

Eugene Vasily Ivash, Ph.D.  
University of Michigan, 1952

The present thesis extends the theoretical treatment of the methyl alcohol molecule given by Burkhard and Dennison, and applies the theory to the interpretation of the microwave spectrum and to an investigation of the structure of the molecule.

The asymmetric hindered rotator model used for the  $\text{CH}_3\text{OH}$  molecule is one in which the OH group and the  $\text{CH}_3$  group are considered to be rigid, the two rotating relative to each other about the symmetry axis of the  $\text{CH}_3$  group. The hindering potential is taken to be  $V = \frac{H}{2}(1 - \cos 3x)$ , where  $H$  is the height of the potential barrier, and  $x$  is the angle measuring the relative rotation of the two groups.

Using the wave functions of Koehler and Dennison for the symmetric hindered rotator, the matrix elements of the Hamiltonian can be calculated, and the energy levels for the asymmetric hindered rotator obtained by diagonalization of the secular determinant. Utilizing the corresponding wave functions, which are determined from the minors of the secular determinant, the selection rules for the asymmetric hindered rotator are obtained. The K-type splitting encountered in certain energy levels, and the selection rules for them, in particular, are discussed.

The parameters used in this treatment of the methyl alcohol molecule are the three moments of inertia  $A$ ,  $C_1$ ,  $C_2$ , the product of inertia  $D$ , the barrier height  $H$ , and the electric moments  $\mu_{11}$  and  $\mu_1$ . Since the three moments and one product of inertia depend upon the six distances necessary to specify the structure of the molecule, information for the other isotopic forms of methyl alcohol besides the normal form must be utilized in order to determine the inter-atomic distances.

The experimental data used to determine the molecular constants are mainly those of Hughes, Good, and Coles, and consist of the measured positions and the Stark coefficients of about ten identified lines for the normal molecule, and a series of lines corresponding to the transitions  $J \rightarrow J$  for the normal molecule, and for two other isotopes. Approximately twenty items of additional information, including the  $(J^2 + J)^2$  coefficients, and the so-called "mirror" lines, are used to verify the results obtained. Utilizing the most suitable combinations of the empirical data, the molecular values are found to be

$\text{OH} = .9374\text{A}$	$\angle \text{HCH} = 109^\circ 30'$
$\text{CO} = 1.4340\text{A}$	$H = 374.8 \text{ cm}^{-1}$
$\text{HC} = 1.093\text{A}$ (assumed)	$\mu_{11} = -.886 \times 10^{-18} \text{ esu}$
$\angle \text{COH} = 105^\circ 56'$	$\mu_1 = 1.439 \times 10^{-18} \text{ esu}$
Distance of O to the symmetry axis = .0790A.	

Microfilm copy of complete manuscript of 101 pages, \$1.26. Enlargements 6" x 8", 10¢ per page.

# BETA RAY SPECTRA OF $\text{He}^6$ , $\text{O}^{15}$ , $\text{F}^{17}$ and $\text{Ne}^{23}$

(Publication No. 3912)

Victor Perez-Mendez, Ph.D.  
Columbia University, 1951

The  $\beta$ -ray spectra of  $\text{He}^6$ ,  $\text{O}^{15}$ ,  $\text{F}^{17}$  and  $\text{Ne}^{23}$  were measured in a 180 semicircular focussing spectrometer. These isotopes were prepared by Deuteron and Neutron bombardment in the Columbia University 36 inch cyclotron by the use of special gas circulating probes devised for this purpose.

A search for possible nuclear  $\gamma$  radiation emitted by these isotopes was made by lead absorption and scintillation counter techniques.

All the spectra investigated had "allowed" spectrum shapes. The "allowed" shape of the  $\text{He}^6$  spectrum together with its low ft value offer strong evidence for the validity of the Gamow-Teller selection rules. The lack of constancy in the  $|M|^2$  ft values for the mirror image nuclei for any one interaction together with some evidence from the "Forbidden" spectra indicates that at least some combination of interactions is required to account for  $\beta$ -ray phenomena.

Microfilm copy of complete manuscript of 79 pages, \$1.00. Enlargements 6" x 8", 10¢ per page.

# THERMIONIC EMISSION AND ELECTRON DIFFRACTION FROM THIN FILMS OF BARIUM OXIDE ON NICKEL

(Publication No. 3858)

Paul Nelson Russell, Ph.D.  
University of Missouri, 1952

An all-glass, sealed-off vacuum tube is described for depositing thin films of BaO by evaporation onto a polished metal receiver. A study of these films is made by measurements of thermionic emission and observations of electron diffraction patterns.

It was found that the temperature of the receiver at the time of deposition influenced the physical state of the BaO film. Thin films deposited under certain conditions indicated a preferential orientation of the BaO crystals. Maximum thermionic emission was reached at about 20 monolayers.

Microfilm copy of complete manuscript of 115 pages, \$1.44. Enlargements 6" x 8", 10¢ per page.



# SOME EXPERIMENTS ON BETA-GAMMA ANGULAR CORRELATION

(Publication No. 3690)

Irving Shakhnov, Ph.D.  
Columbia University, 1951

This paper is concerned with the determination of the form of the Hamiltonian describing beta-decay by means of experiments measuring the angular correlation of successive beta and gamma decays. The formulation of the theory of beta-decay is reviewed and the theory of the angular correlation of successive decays is summarized. It is found that the angular correlation is principally dependent on the assumed interaction, the nuclear spin of the states involved, the multipolarity of the gamma radiation, and the energy of the beta-ray. An experimental arrangement to measure the correlation is described, together with tests performed on the equipment. Results of measurements on  $\text{Rb}^{86}$ ,  $\text{Sb}^{122}$ ,  $\text{Cs}^{95}$ ,  $\text{Au}^{198}$ , and  $\text{Sb}^{124}$  are given. In those substances where anisotropy exists the results favor the tensor interaction.

Microfilm copy of complete manuscript of 66 pages, \$1.00. Enlargements 6" x 8", 10¢ per page.

# THE EXPERIMENTAL DETERMINATION OF CROSS SECTION PER UNIT SOLID ANGLE FOR THE ELASTIC SCATTERING OF DEUTERONS BY TRITONS AND THE ELASTIC SCATTERING OF PROTONS BY DEUTERONS AS A FUNCTION OF SCATTERING ANGLE AND INCIDENT DEUTERON ENERGY

(Publication No. 3961)

William Robert Stratton, Ph.D.  
University of Minnesota, 1952

The differential cross section per unit solid angle for elastic scattering of deuterons by tritons and protons by deuterons has been measured as a function of angle relative to the incident deuteron beam and as a function of incident deuteron energy. Deuteron-triton data were obtained between  $44^\circ$  and  $126^\circ$ , and deuteron-proton data were obtained between  $67^\circ$  and  $126^\circ$  (center of mass system of coordinates). The energy range for both experiments was between 0.96 Mev and 3.22 Mev.

The beam of deuterons was passed through a small volume chamber filled with either tritium or hydrogen. The beam was collimated by a slit system in the chamber and was collected in an insulated evacuated charge collector cup. A system of slits before the proportional counter defined the portion of the beam from which scattered particles could enter the counter.

Charge collected during one run was stored on a 0.510 microfarad condenser. The condenser was discharged through a calibrated ballistic galvanometer at the conclusion of a run.

The pressure of the gas in the chamber was measured by a Wallace and Tiernan diaphragm linkage type differential pressure manometer.

The energy of the deuteron beam was controlled and measured by an electrostatic analyzer using the singly ionized molecular beam for this purpose.

The voltage pulse resulting from a charged particle passing through the proportional counter was amplified by a model 100 amplifier and counted by a 10-channel pulse height analyzer.

The tritium gas was stored and purified, when not in use, in the form of uranium tritide ( $\text{UT}_3$ ). The relative amounts of tritium and hydrogen in the sample of gas were measured each time before it was used.

The cross section for the elastic scattering of protons by deuterons was measured by observing the recoil protons. These data, when examined in the center of mass system of coordinates, show strong nuclear scattering. At all energies studied, the cross section is high at low angles, drops to a minimum near  $90^\circ$  and rises in the backward direction. Nuclear scattering is strongest at 3.22 Mev, the highest energy studied, and weakest at 0.96 Mev, the lowest deuteron energy studied. The value of the cross section at 0.96 Mev and  $100^\circ$  (C.M.) is 0.247 barn; at 3.22 Mev and  $90^\circ$  it is 0.144 barn. The probable error associated with these data is equal to or better than 3%, except the highest angle which has an error of 4 to 5%.

The cross section for the elastic scattering of deuterons by tritons was measured by observing scattered deuterons and recoil tritons. These data indicate very strong nuclear scattering. At any energy, the cross section plotted as a function of angle has a minimum near  $90^\circ$  (C.M.). Between 1.20 Mev and 1.97 Mev the minimum value is at  $85^\circ$ . Above 1.97 Mev deuteron energy the minimum moves steadily toward higher angles. At 3.22 Mev the minimum is at  $95^\circ$ . The cross section at the minimum at 1.20 Mev is 0.130 barn and at 3.22 Mev it is 0.020 barn. The probable error connected with these data is between 5% and 6%, except at the lowest and highest angle where it is 9%.

Microfilm copy of complete manuscript of 105 pages, \$1.31. Enlargements 6" x 8", 10¢ per page.

# A STUDY OF THE THERMOELECTRIC EFFECT AND THE ELECTRICAL CONDUCTIVITY OF $(\text{BaSr})\text{O}$ AND $\text{BaO}$

(Publication No. 3868)

James Roger Young, Ph.D.  
University of Missouri, 1952

A study has been made of the thermoelectric power and the electrical conductivity of  $(\text{BaSr})\text{O}$  and  $\text{BaO}$  in different states of activation and on two base metals over a temperature range of 1100°K to 300°K.

The conductivity of the oxide was found to obey a relation of the form  $\sigma = A_1 e^{-\frac{Q_1}{RT}} + A_2 e^{-\frac{Q_2}{RT}}$ . The temperature dependence of the thermionic emission was found to be the same as the temperature dependence

of the conductivity at temperatures between 700°K and 1100°K. The slope of the thermoelectric power versus reciprocal temperature was also similar to the work function and activation energy at the higher temperatures.

The thermoelectric power was found to vary with temperature having a value of about 2.0 millivolts per degree at 1100°K, increasing to about 2.5 millivolts per degree at 800°K and reducing to between 1.0 and 0.5 millivolts per degree at about 500°K. At still lower temperatures the thermoelectric power was observed to remain practically constant or to increase slowly. In all thermoelectric power measurements the hot junction was positive indicating an N type semiconductor.

The simple theory of the electronic semiconductor does not adequately explain the experimental measurements. The results seem to be in good agreement with the pore conduction hypothesis.<sup>1,2</sup>

<sup>1</sup> R. Loojes and H. J. Vink, *Philips Res. Rep.* 4, 449-475, (1949).

<sup>2</sup> E. B. Hensley, Thesis, University of Missouri, (1951).

Microfilm copy of complete manuscript of 104 pages, \$1.30. Enlargements 6" x 8", 10¢ per page.

## WOOD TECHNOLOGY

### AN INVESTIGATION OF METHODS OF IMPROVING THE BONDING QUALITIES OF SOYBEAN GLUE

(Publication No. 3734)

Ying-chang Cheo, Ph.D.  
University of Michigan, 1952

The present study was undertaken to investigate methods of improving the bonding qualities of soybean glue by developing formulations that would be economically feasible in underdeveloped Oriental countries.

The experimental work consisted of five parts: (1) bonding qualities of different soybean meals; (2) effect of hardener concentration on the bonding qualities of soybean glue; (3) fortification of soybean glue with casein glue and blood albumin; (4) fortification of soybean glue with synthetic resin adhesives; (5) mold resistance of a fortified soybean glue developed from this investigation. Each part constitutes an approach to the improvement of soybean glue.

The bonding qualities of the various glue formulations investigated were determined by three types of test, viz., plywood shear test, delamination test, and block tension test. The first two types of test were made on three plies of 1/16" rotary-cut birch veneer, while the third type was made on 3/4" birch lumber.

The results show that fortification with 20% casein glue, 10% blood albumin, and 3% formalin, based on the weight of soybean meal, is an effective and practical method of improving the water resistance and joint strength of soybean glue. Formalin is an important agent in this formula in rendering the soybean protein insoluble; the procedure of introducing it into the glue mixture without causing coagulation is described. The mold resistance of this fortified soybean glue can be effectively increased by addition of 5-7% of sodium trichlorophenate.

Improvement of bonding qualities of soybean glue through increasing the concentration of hardening agents, lime and tetrasulphide mixture, with Monsanto's extra mix formula, seems to be rather limited. Brier's mechanically isolated soybean protein is more economical for adhesive use than other meals with denatured protein. The effect of the amount of water required for different soybean meals in the preparation of glue, as related to bonding performance, is discussed.

In regard to fortification with synthetic resin adhesives, it was concluded that resorcinol-formaldehyde resin, or any other resins which require formaldehyde for polymerization, will not be suitable for fortifying the regular soybean glue, which is highly alkaline.

Since all the four major synthetic wood adhesives of high water-resistance and durability include formaldehyde-yielding compounds as catalysts, two approaches to this problem were undertaken. One is to use some other types of resin having no formaldehyde component; the other is to disperse the soybean meal with acid chemicals. The latter approach is based on one of the experimental findings that soybean glue under acid conditions will not undergo coagulation when in direct contact with formaldehyde, as it does immediately under alkaline conditions. The disclosure of this behavior opens a way for fortifying soybean glue with urea-formaldehyde resin. However, it was found that the adhesive strength of soybean meal on the acid side is low, and a substantial amount of resin is required. Although suggestions are made for further research along this line and with the use of non-formaldehyde resins, the present investigation has demonstrated that fortification of starch glue with resorcinol resin is far more promising and simpler than that of soybean glue with similar resins.

Microfilm copy of complete manuscript of 150 pages, \$1.88. Enlargements 6" x 8", 10¢ per page.



## RELIGION

### THE MORAVIAN DIASPORA: A STUDY OF THE SOCIETIES OF THE MORAVIAN CHURCH WITHIN THE PROTESTANT STATE CHURCHES OF EUROPE

(Publication No. 3696)

John Rudolf Weinlick, Ph.D.  
Columbia University, 1951

The student of church history conceives of the Moravian Church primarily in terms of foreign missionary activity, or perhaps in terms of pietistic communities like Herrnhut, Saxony, and eighteenth century Bethlehem, Pennsylvania. Equally significant is the Moravian Diaspora, the activity of the Moravians within the Protestant state churches of Germany, and other European countries. Indicative of the scope of this work is the fact that while the membership of the Moravian Church on the Continent has only of recent years exceeded 10,000, that of the Diaspora societies is estimated to have been over 75,000 at its peak.

Because of the somewhat amorphous nature of the Diaspora, Moravian historians have given it only scanty treatment. Scattered references in history books, in periodicals, in synod reports, have failed to do full justice to the importance of the Moravian Church as an inter-church society alongside of its existence as a denomination. This thesis presents the story of the Diaspora from the historical point of view distinct as far as possible from the general history of the Moravian Church. It follows the development of the enterprise from its inception in the mind of Count Zinzendorf, through its various stages, to its present status in postwar Europe.

Nurtured in Pietism, Zinzendorf envisioned an inter-church fellowship which he called the "Congregation of God in the Spirit," held together by "heart religion," a deep personal attachment to the human Jesus, especially in the aspect of his physical sufferings. The coming of the refugee remnant of the Bohemian-Moravian Brethren to his Saxon es-

tate introduced an unexpected element, the renewal of the pre-Reformation *Unitas Fratrum*. Nevertheless, the Count's original ideal prevailed, the inter-church fellowship growing up alongside of the Moravian Church as a denomination. The rise of the Renewed Moravian Church, counter to Zinzendorf's wishes, paradoxically, was the very thing needed for the realization of his ideal. The warm piety of the exclusive Moravian settlements made the Brethren the symbol for an emotional Christo-centric point of view widely disseminated outside of their own circle through itinerant Diaspora workers, correspondence, literature and songs.

There are at least five ways in which the Moravians through their Diaspora made a contribution: (1) in acting as a leavening influence upon the various state churches, (2) in awakening interest in foreign missions, (3) in helping to prepare the way for inner missions on the Continent, (4) in furnishing a pattern for Protestant unity, (5) in influencing the whole romantic movement both within and beyond the realm of religion.

Moravian influence was at its height during the period of late eighteenth century rationalism when the low state of spiritual life in the state churches drove many to seek the warmth of the Diaspora societies. Yet the Moravians, true to Zinzendorf's stand, continued to insist upon loyalty to the established church among their Diaspora constituency. The two-fold status of the Moravians as a denomination and as a society remain, but the center of gravity has shifted to the side of the denomination, especially since the middle of the last century. The Diaspora, at one time the elite company of Zinzendorf's Congregation of God in the Spirit, is more accurately designated today as "friends of the Moravian Church". These friends are the source of outside help which enabled a numerically small denomination to maintain its extensive foreign and inner mission work.

Microfilm copy of complete manuscript of 335 pages, \$4.19. Enlargements 6" x 8", 10¢ per page.

## SOCIAL SCIENCES

### ANTHROPOLOGY

#### THE TOLTECS AND THEIR INFLUENCE ON THE CULTURE OF CHICHEN ITZA

(Publication No. 3881)

Bertha Pauline Dutton, Ph.D.  
Columbia University, 1952

Tula, or Tollan, has been intriguing investigators, sporadically, almost as long as Mexico has been known to European peoples. The Toltec founders had a highly advance culture. Tula was described as a magnificent place with great pyramids and temples devoted to the cult of Quetzalcoatl.

In 1873, a commission visited Tula, Hidalgo, and its vicinity and reported notable archaeological remains. In 1880, the French explorer, M. Desire Charnay, carried on limited excavations there. Then fifty years passed before interest in Tula was reawakened. During that interval, attention centered on Teotihuacan, a ruin some 40 miles southeast of Tula, and certain investigators concluded that the Toltecs were to be identified with that site. One of the reasons for believing Teotihuacan to be the Toltec center was that, in keeping with the archaeological sequences as then revealed for the Valley of Mexico, the Teotihuacan period was thought to have just preceded the Aztec period, and, according to the chronicles, the Toltecs were the immediate predecessors of the Aztecs.

Meanwhile, an archaeological period was isolated in Yucatan, wherein there occurred a complex of foreign traits, generally identified as Mexican. Similarities which had long been noted between traits found at Tula and at Chichen Itza, Yucatan, were of this horizon at the peninsular site. And many of the Mexican elements found at Chichen Itza were absent at Teotihuacan.

Excavations conducted in 1931-1932 at San Francisco Mazapan, an outlying point at Teotihuacan, revealed a cultural stratum occurring between the latest Teotihuacan phase and the earliest Aztec level. This intervening horizon was called "Mazapan." Later, excavations at Tula proved that the ceramic material there related to the Mazapan horizon, thus placing Tula chronologically as of post-Teotihuacan date. Since the Mazapan-Tula culture is stratigraphically later than the Teotihuacan horizons, Teotihuacan could not be the Tollan of traditional history. Indeed, Tula was the center of the ancient Toltecs.

Although the term "Toltec" has been used in a number of ways, in the present report Toltec refers to the culture which is typified by the archaeological remains at Tula, and which was disseminated over an extensive area approximately A.D. 850-1150.

Since 1941, excavations at Tula have disclosed imposing buildings and significant sculptures; and each

season's work reveals more and more striking resemblances between Tula and Chichen Itza. The present study demonstrates these similarities, and, insofar as possible, accounts for this phenomenon. Forty-five traits are enumerated as common to Tula and Chichen Itza (not including many items which lack diagnostic significance); and certain of these are unknown from any other location. It seems evident that many culture elements were transferred from Tula to Chichen Itza in a relatively pure state. This implies that the transfers were fairly direct, and that they were made by migrants from the one place to the other.

Many Mexican accounts tell of the leaving of Quetzalcoatl from Tula, of his going to the east; and in the Maya records there are corresponding narratives of Quetzalcoatl (Kukulcan), who came from the west, returned to Mexico, and came again to Yucatan. On the basis of the evidence assembled, it appears that possibly three epochs of Toltec influence may be distinguished at Chichen Itza:

(1) Prior to A.D. 987 (but after 856 - - when Tula is believed to have been established), when an original Quetzalcoatl may have gone from Tula to Chichen Itza with a few Toltecs.

(2) About A.D. 987, when a personage bearing the name of Quetzalcoatl-Kukulcan, arrived at Chichen with many followers.

(3) The late twelfth century (after the downfall of Tula in 1168), when a military leader, perhaps called Quetzalcoatl, went to the aid of Hunac Ceel, the Mayapan chieftain who conquered Chichen Itza.

It is shown that the Toltec traits at Tula and Chichen Itza were contemporaneous for the most part. Within a century after the Toltecs had established themselves at Tula and developed a distinctive culture, noticeable influence was passing from the central highlands to the Yucatecan peninsula. From then on, Toltec strength increased and effected more and more of the peoples living between Tula and Chichen Itza. Toltec influence persisted at Chichen Itza for over two centuries.

Microfilm copy of complete manuscript of 256 pages, \$3.20. Enlargements 6" x 8", 10¢ per page.

#### AN ANTHROPOLOGICAL ANALYSIS OF THE PROBLEM OF CHRONIC DISEASES AMONG THE THONGA PEOPLES OF SOUTHEAST AFRICA: A CASE STUDY IN APPLIED ANTHROPOLOGY

(Publication No. 3684)

Antonio Jose de Liz Ferreira, Ph.D.  
Columbia University, 1952

This thesis is a case study in applied anthropology. It is an attempt to introduce the modern ideas



of preventive medicine among the Thonga natives. The Thonga habits of hygiene and sanitation are, for the most part, responsible for the recurrence of chronic infectious and parasitic diseases. Only if we replace these faulty habits by measures prescribed by modern preventive medicine may the recurrence of these diseases be checked. The Thongs beliefs about health and disease are the outcome of basic, implicit assumptions concerning the nature of the universe, human nature and conduct. These accepted conceptions are ways of ordering and interpreting man's experience, and as such, they pervade the culture, giving it an underlying similarity and unity of meanings and relationships, while affording outlets for the release of anxieties.

The first section describes the old Thonga culture. It was a cooperative society characterized by a hierarchy of rank and age, a system of patrilineal clans ruled by a chief, each clan being divided into villages ruled by headmen and their extended families, subsistence agriculture with a sharp sex division of labor, and working parties. The universe was seen by the natives as a total dynamic configuration of structures permeated by entities or forces including gods and man. The harmony of this whole was, however, dependent upon man's actions and his fulfilling the cultural rules. Disease was a sign of lack of harmony and could be prevented by man's fulfilling the rules of society -- disease always being caused by gods, heaven, or witches. Medicine was both empirical and magical. Great prestige was accorded to the medicine men. Thonga religion was based on the cult of ancestral spirits: man became a god after death.

Section two shows that the actual Thonga population was pushed into relatively restricted areas as a result of the impact of Western civilization. The high birth and death rates and the imbalance between the youth and individuals in productive age reveal that the population is under stress. Culture disintegration was found everywhere, either direct in the mining and plantation areas, or indirect in marginal areas. The traditional anxiety-relieving mechanisms are being destroyed, and no new mechanisms are as yet available to cope with this situation. Western patterns of competition which have been grafted onto the native culture have added increasing sources of anxiety. In general, signs of intense individualism and competitiveness which are followed by increased psychological isolation and insecurity were found. The constant presence of anxieties, the lack of food, and the recurrence of chronic diseases make for a serious maladjustment between the culture and the environment.

In the third section we described the sub-district of Vilanculus as a marginal area characterized by indirect acculturation of the population, great poverty, and high incidence of chronic diseases. The medicine men were found to be the greatest barriers confronting European medical assistance.

In the last section a practical plan to apply preventive medicine with the help of anthropological and social-psychological methods was tentatively presented. It was proved that the natives are able to learn the methods of hygiene provided they are prop-

erly motivated and rewarded. Among the methods employed to bring about effective individual decisions concerning the adoption of the rules of preventive medicine were those based on group decisions as advanced by Kurt Lewin. Practical procedures to train the medicine men and transform them into efficient health agents were proposed. It was realized that an improvement in the economic conditions was a requirement for the success of this social planning, as envisaged by this study.

Microfilm copy of complete manuscript of 229 pages, \$2.86. Enlargements 6" x 8", 10¢ per page.

#### THE RELIGION OF AN AMAZON COMMUNITY: A STUDY IN CULTURE CHANGE

(Publication No. 3884)

Eduardo Eneas Galvão, Ph.D.  
Columbia University, 1952

This monograph is a study of the religious life of one community, the village of Itá, (a fictitious name), located on the mainstream of the lower Amazon River in Brazil. It is primarily a study of a local manifestation of a regional folk religion.

The modern inhabitants of this area, the so-called caboclo, are people of mixed American Indian and Portuguese stocks. Their culture is strongly influenced by American Indian traditions but the caboclo is a Catholic and most of his religious ideology revolves around the cult of the saints. Each community in the Amazon has a patron saint but other saints are worshipped in the local neighborhoods. The cult of the saints is given organization by the local institutions called irmandades (religious brotherhoods) which are generally autonomous of the official church. These brotherhoods are of considerable importance since they furnish the local neighborhoods of the Ita community with a form of social structure which administers customary law.

In Itá the saints are benevolent beings. The people believed them to have a power of their own. People appeal to them through collective prayers and vows. They approach the saints directly and not through intermediaries. They depend upon the saints for the general welfare for themselves and for the community.

In addition to the cult of the saints, the caboclo has other concepts and religious institutions which cannot be considered Catholic. These derive mainly from the Indian background. These Indian-derived supernaturals are believed to inhabit the rivers or the forest. There is the Boto, a fresh water dolphin, the Curupira, a forest goblin; the "Giant Snake"; and many other spirits and beings of various descriptions. In the main, these supernaturals are malevolent and they are believed to control the natural environment. There is no cult of these Indian-derived supernaturals. Only specialists, the shamans or pagés, can deal successfully with them. Through their special powers the shamans are able to control such supernaturals, and able to use them as helpers in curing or in witchcraft.

Shamanism is perhaps the strongest Indian-derived institution in the folk religion of the contemporary Amazon caboclo.

The development of religious ideas and institutions is a reflection of the whole process of acculturation and culture change in the Amazon Valley. This process was begun early in the seventeenth century with the disruption of tribal societies and the breakdown of native cultural and social configurations. The tribal cultures were levelled by the concentration of diverse peoples in mission or colonial villages. A considerable part of the Indian culture did persist but it, in turn, was heavily influenced by the Portuguese culture. Native beliefs have survived in the Amazon Valley, but out of their aboriginal context. They have a different function in the modern folk culture of Itá than they did in aboriginal times.

The formation of the contemporary folk religion of the Amazon caboclo has not been merely a process of addition or loss of institutions and patterns peculiar to its two main components, Iberian Catholicism and Indian religion. It has resulted from a process of selective acculturation, conditioned by the particular configuration of each of the contributing cultures, as well as by historical and ecological factors.

Microfilm copy of complete manuscript of 193 pages, \$2.41. Enlargements 6" x 8", 10¢ per page.

## AGRICULTURAL ECONOMICS

### PROBLEMS IN MEASURING AND ANALYZING MARKETING MARGINS FOR SELECTED FRUITS AND VEGETABLES

(Publication No. 3939)

Herbert Wayne Bitting, Ph.D.  
University of Minnesota, 1952

The need for an accurate measurement of marketing margins and their breakdown among the various stages in the marketing process has long been recognized. The specific purpose of this thesis is the development of techniques which may be utilized in the measurement of these margins.

The first phase of the study involved the selection of a sample of retail stores in Pittsburgh from whom necessary price, sales, purchases and other data could be obtained, and which could serve as a basis for tracing back to f.o.b. shipping point the various purchases made by the retail establishments. In order to delimit the study, the development of techniques for the measurement of margins has been confined to the measurement of apples among the selected stores in Pittsburgh for the period December 1949 through May 1950.

The first step in the development of techniques in the measurement of marketing margins is the determination of price specifications necessary for relating services performed to margins taken and lo-

cating specific points in the marketing process to obtain price information.

In order to obtain price information for comparable services it is necessary to select uniform points in the marketing level, between the producer and the ultimate consumer, for the purpose of collecting prices. Specific points in the marketing process were selected for purposes of measuring the margins of retailing, wholesaling, and the cost of transporting from f.o.b. shipping point to delivery at the terminal market. Retail purchase prices were adjusted, where needed, to the delivered-at-store price. Wholesale purchase prices were obtained on the basis of per unit costs for full cars or trucks delivered at the terminal market. By this means it was possible to relate margins to services performed to insure price comparability between marketing agencies.

The second step involved setting up criteria for obtaining price information for comparable quantities. In this connection particular emphasis was given to the handling of spoilage. It was pointed out that because of spoilage the per pound price at the farm level was not the equivalent of the per pound price at the retail level. The key to obtaining accurate price information for comparable quantities is to report the price for equivalent quantities of a product after taking spoilage into account, at each specified point of delivery for comparable qualities of the product sold under similar terms and conditions during the specified time.

The next step involved obtaining price information for comparable qualities. Quality has been defined to include those factors that affect the homogeneity of a commodity as measured by retail prices. Such factors as area of production or State of origin, variety, size, and grade were examined.

Results of the tests for comparable qualities showed that Northwestern apple prices were significantly higher than Eastern apple prices. Prices for Eastern apple varieties were significantly different during some months but not for others.

According to these results it would appear that Northwestern apple price data should be collected separately from Eastern apple prices. It would appear desirable to collect apple prices separately for the major varieties of apples.

The final step involved the separation of stores into groups preliminary to testing the hypothesis that significant differences exist among both prices and margins taken by stores grouped according to their methods of buying produce. It was determined that significant differences did exist in both selling prices and margins between stores grouped according to their methods of buying produce. Therefore price information should be collected separately for each of the store groups.

This study demonstrates the type of price information needed in order to measure marketing margins more accurately than is possible from the price information now available from the regular market news reporting agencies.

Microfilm copy of complete manuscript of 176 pages, \$2.20. Enlargements 6" x 8", 10¢ per page.



# **HISTORICAL DEVELOPMENT AND EVALUATION OF THE FARM MANAGEMENT SERVICE ASSOCIATIONS IN THE UNITED STATES**

(Publication No. 3952)

Milton Lloyd Manuel, Ph.D.  
University of Minnesota, 1952

The farm management service program carried on in the Farm Management Service Associations has been in operation in the United States for 27 years. The program has developed quite independently in each of the five states employing it. Because of this, the program of the association has not been studied and analyzed as one over-all development in the field of farm management. This study has as its main objective to study these organizations as one development in order to determine (1) what place this program occupies in the over-all field of farm management, and (2) to what extent the program has accomplished established objectives.

Pertinent information was assembled from both primary and secondary sources. Personal interviews were arranged with key personnel in charge of the program in each of the five states. The latter proved to be a most valuable source of information for making this study.

Associations are currently in operation in Illinois, Minnesota, Iowa, Kansas and Wisconsin. The scope of this program may be indicated by pointing out that 34 fieldmen currently are employed for a total membership of more than 6700 farmers located in 279 different counties. The present development is an outgrowth of the small beginning which took place in Illinois in 1925 when the first Association of 235 members was established. Although the programs in each of the states have developed quite independently, they are fundamentally quite similar. Much of the similarity can be traced to the fact that the program in each state was patterned either directly or indirectly after that in operation in Illinois. Variations that are present appear to be due to differing needs and differences in views of personnel employing this kind of organization.

It was learned that although the Associations are a relatively new development in farm management, that many of its features stem from earlier programs. An examination of some of the major historical developments which have taken place in farm management research and extension explain many of the features found in this program at the present time.

Because this type of organization represents a three-way cooperative arrangement, special considerations must be given to the relation of contributions made to benefits received for each cooperating party. The ratio of benefits flowing from the program to each party must be in approximate agreement with the ratio of contributions each makes to the total program. Only by keeping these two ratios in approximate balance over a period of time can the organization function satisfactorily.

It was concluded that the one most important function of the Associations is to serve as a service agency to assist farmer-members with farm management

problems. At the same time, research and extension aspects of the program are important. The amount of emphasis being given to each phase of the program varies by states. Research aspects are stressed in Minnesota; extension aspects receive major consideration in Iowa, Kansas and Wisconsin; while that in operation in Illinois represents an unusually even balance between the two.

Any evaluation that is made must consider the total program as an integrated unit. By evaluating the program of the Association in light of their established objectives it was concluded they have accomplished all that was expected of them from the standpoint of serving as a tool of the extension service and as a service agency to help members with their farm management problems. In regard to research aspects of the program it was learned that considerable variations exist concerning the extent to which research objectives have been achieved. Research work that is performed primarily for members is being conducted in all five states. Research work which deals with the more fundamental aspects of farm management appears to be limited to the program in operation in two of the five states.

Microfilm copy of complete manuscript of 241 pages, \$3.01. Enlargements 6" x 8", 10¢ per page.

## **BUSINESS ADMINISTRATION**

### **ELEMENTARY ACCOUNTING FOR GENERAL - BUSINESS STUDENTS**

(Publication No. 3871)

Charles William Bastable, Jr.  
Columbia University, 1952

In view of current criticisms that elementary accounting courses are not suitable for nonaccounting majors, the purpose of the dissertation is to consider the objectives of elementary accounting education for general-business students and to develop the manner in which such objectives may be attained through appropriate instruction. Emphasis is on proper development of accounting theory, course content, and sequence of presentation, rather than on pedagogy.

After an analysis of current elementary accounting courses, which reveals that most courses devote a great deal of time to bookkeeping in order to provide a foundation upon which the professional training of an accounting major may be based, consideration is given to an elementary accounting course for general-business students. The broad educational objective of the course is to provide an adequate knowledge of accounting so that an individual may discharge administrative or managerial responsibilities unhampered by deficiencies in accounting. The philosophy underlying the course recognizes five basic considerations: (1) selection of a proper starting point for the introduction of accounting, (2) logical development of subject matter, (3) selection of accounting techniques that are not

confusing or misleading in the presentation of new material, (4) emphasis on implications of accounting data rather than bookkeeping techniques, and (5) consideration and appraisal of the objectives of accounting.

Apropos of a starting point for the introduction of accounting, a new approach, the recoupment approach, is developed. Business operations are considered first, and the income statement is introduced next as the means for measuring the results of operations. Ledger accounts are then considered as the source of information for the income statement. Finally, the balance sheet is presented as a "way-station" between successive income statements.

An elementary accounting course for general-business students is outlined, with due regard for the fact that the course will be a terminal one for many students and the fact that the problem of marginal utility arises with respect to the inclusion of topics. The course is intended for collegiate sophomores or juniors, and it is designed to cover two semesters of sixteen weeks each. First-semester topics are the recoupment approach, the recording function, and accounting for assets. Second-semester topics are liabilities, corporate accounts, manufacturing, cost accounting, budgeting, partnership accounting, federal income tax, multi-unit enterprises, analysis and interpretation, and appraisal of accounting.

In addition to the foregoing, regard is given to supplemental considerations in an elementary accounting course. These are: (1) organization and size of classes, (2) assignment and submission of problems, (3) examinations and quizzes, (4) use of visual aids, (5) selection and use of a text, and (6) assignments of supplementary readings.

In concluding, attention is invited to the problems that a segregation of accounting majors and general-business students may not be possible until students have first taken an elementary accounting course. Accordingly, the feasibility of placing accounting majors in a course designed for general-business students is discussed and such a merger is recommended. As for the general-business student, the proposed course, with its minimum of emphasis on bookkeeping, should install a better understanding of accounting and the role of the accountant than traditional courses have succeeded in doing heretofore.

Microfilm copy of complete manuscript of 128 pages, \$1.60. Enlargements 6" x 8", 10¢ per page.

#### SOME ECONOMIC EFFECTS OF MARKETING RESEARCH

(Publication No. 3796)

Stewart Henry Rewoldt, Ph.D.  
University of Michigan, 1952

Marketing research, although of relatively recent origin, has increased rapidly in importance during the first half of the twentieth century, particularly since 1920. This is a study to determine some of the economic consequences of this growth in marketing research.

Two particular marketing research methods are used as the basis for this study. They are the retail store audit of the A. C. Nielsen Company and the consumer purchase panel of Industrial Surveys Company. These two marketing research methods are chosen because they reflect better than most others trends in the development of marketing research. The nature and use of these marketing research methods are examined in detail and conclusions drawn concerning their economic effects.

It is concluded in this study that the continued and increasing use of retail store audit and consumer purchase panel data can be expected to produce the following economic effects:

1. A more rational direction of economic effort in the sense that they make possible a more efficient use of economic resources. This conclusion is based on the fact that use of these data increases sales (output) per unit of selling effort (input). This more efficient use of economic resources produces directly an increase in the plane of living of consumers. It also raises the plane of living of consumers in a more round-about way, because use of these data increases the marginal efficiency of capital which, in turn, leads to a higher level of employment and income.

2. A change in the nature of competition in that use of these data creates a tendency to increase the use of non-price competition relative to price competition and, in addition, produces a tendency to use those forms of non-price competition to which retaliation is most difficult. This conclusion is based on the fact that the availability of these data to competing firms increases the fear of retaliation to competitive moves and, consequently, directs competition into channels where retaliation is least likely.

3. A tendency to reduce the number of competitors. The use of these data is at present limited to a small number of relatively large firms. Users of these data possess a competitive advantage relative to non-users. There are obstacles to the use of these data by small firms which can be overcome only with great difficulty. This reduction in the number of competitors will change the nature of competition. Its effect upon the amount and intensity of competition, however, is not clear.

4. A greater likelihood that a planned economy will be substituted for the American free enterprise economy. These data give an advantage to large firms relative to small. This may stimulate demand for government action to protect the small businessman. At the same time, the availability of these data increases the effectiveness with which a planned economy can be expected to operate because they serve as a partial substitute for a free market as a guide to productive effort.

Microfilm copy of complete manuscript of 200 pages, \$2.50. Enlargements 6" x 8", 10¢ per page.



## ECONOMICS

INVENTORIES AND THE BUSINESS CYCLE WITH  
SPECIAL REFERENCE TO CANADA

(Publication No. 3938)

Clarence Lyle Barber, Ph.D.  
University of Minnesota, 1952

To understand the cyclical behavior of inventories it is first necessary to determine the conditions under which an accumulation or liquidation of inventories can take place. Analysis of a simplified model of the economic system shows that no accumulation of inventories can occur until the level of production exceeds the equilibrium level of income, that is, the income level where the savings schedule intersects the schedule of investment in durable assets. Lags in consumer expenditure temporarily increase the propensity to save and hence make it easier to realize inventory plans. Lags in investment expenditures have a similar effect. Price changes also facilitate the realization of inventory plans in that price increases can be used to defend inventory positions and price reductions can be used to clear surplus stocks. On the other hand sudden shifts in either the savings or investment schedule may make it more difficult to accumulate or reduce stocks and if these shifts occur more frequently at cyclical turning points this may explain why there is often a long lag in inventories at that time.

In this setting it can be shown that investment in inventories may reinforce cyclical expansions and contractions and may be an important cause of cyclical downturns or revivals.

Changes in the value of inventories entirely due to price changes may also have important effects on the level of economic activity. These effects would be minimized if price were always based on replacement costs so that price induced changes in inventory value were fully reflected in reported profits and these inventory profits or losses were completely discounted for policy purposes. But in many industries prices are based on actual rather than replacement cost so that these changes in inventory value may have to be financed with borrowed funds. Further, even where the change in inventory value is reflected in reported profits, business firms may often be unaware of the windfall nature of these profits. Hence, these changes in inventory value may often be an important aggravator of inflation and deflation.

A study of inventory behavior in the Canadian economy reveals that in the period 1926 to 1950 investment in inventories accounted on the average for about 9 per cent of the cyclical change in income. Compared with Abramovitz's findings this means that investment in inventories has only been about one-third as important in Canada as a cause of cyclical change as it has in the United States. This is due to the less frequent occurrence of minor recessions in Canada and to the greater willingness of Canadian business firms to allow their stock-sales ratio to rise in time of depression.

Canadian data show that the cyclical behavior of

inventories is much more irregular than could have been expected. Though over the cycle as a whole investment in inventories usually exerts a reinforcing influence this effect may often be extremely large in individual years only to be followed by an opposite or much smaller movement in the succeeding year. In some years inventories appear to be an important factor in contributing to cyclical turns. In other years their influence is completely offset by opposite movements in other expenditures. This is partly explained by the irregular movement of grain inventories and to lesser extent mining, railway, and public utility inventories.

A detailed study of ten manufacturing industries shows that for most industries inventories follow production with a long lag at cyclical turning points. In some industries this lag reflects a deliberate policy of inventory accumulation. In others it appears to be largely involuntary.

Microfilm copy of complete manuscript of 248 pages, \$3.10. Enlargements 6" x 8", 10¢ per page.

BANKING POLICY AND ECONOMIC  
DEVELOPMENT: A BRAZILIAN CASE STUDY

(Publication No. 3719)

Morris Bornstein, Ph.D.  
University of Michigan, 1952

The purpose of this study is to investigate the organization and operations of the Brazilian banking system and certain related financial institutions in recent years and to examine their past and potential contribution to the financing of economic development in Brazil. Two responsibilities of banking policy are distinguished: 1) to keep the supply of money in appropriate relation to the supply of goods and services in order to restrain inflation, and 2) to distribute this money supply properly among alternative producers or sectors of the economy in order to promote balanced economic development.

In Chapter I of the study, both aspects of banking policy are considered in an analysis of the problems and principles involved in planning and financing economic development in underdeveloped countries. After a brief survey of the chief characteristics of the Brazilian economy in Chapter II, a case study of the extent to which the banking system and financial institutions of Brazil have fulfilled these twin responsibilities is presented in Chapters III-VII. Central banking and the control of the quantity of credit are discussed in Chapter III, while Chapters IV, V, VI, and VII deal, respectively, with commercial banks, the Bank of Brazil, savings banks, and security markets, social security funds, and insurance and capitalization companies.

Three principal conclusions are reached in this study. 1) The monetary and fiscal authorities have failed to control the money supply and curb inflation in Brazil. Weak central bank and Treasury policies permitted the combination of private credit expansion, Treasury borrowing at the Bank of Brazil, and the wartime accumulation of foreign exchange to expand

the money supply 450 per cent from 1939 to 1949; during the same period prices rose 350 per cent.

2) The financial institutions of Brazil have not distributed their loans and investments so as to promote national economic development. Commercial banks have concentrated unduly on short-term commercial loans, often for speculative purposes, and have neglected both agricultural financing and investments in government and corporate securities. The Bank of Brazil has financed Federal budget deficits and provided a small number of farm and livestock loans. Brazilian savings banks, insurance companies, and social security funds have devoted the bulk of their resources to investments in, and mortgage loans for, high-cost urban commercial and residential construction, displaying little interest in long-term industrial financing, the purchase of government securities, or the construction of low-cost housing.

3) A number of changes in the policies and organization of the Brazilian banking and financial system would facilitate the financing of economic development in Brazil. To curb inflation, the Government should limit private credit expansion and finance Treasury budget deficits through bond sales to the nonbank public and to commercial banks rather than through borrowing at the central bank. To encourage the proper distribution of the supply of credit, the composition of the loan and investment portfolios of commercial banks and collective savings institutions should be regulated through selective controls and specialized institutions should be created to furnish agricultural and industrial credit.

Microfilm copy of complete manuscript of 476 pages, \$5.95. Enlargements 6" x 8", 10¢ per page.

#### COORDINATION IN CANADIAN FEDERAL FINANCE

(Publication No. 3682)

Harvey Elliot Brazer, Ph.D.  
Columbia University, 1951

The financial aspects of federal union in Canada have, for almost eighty-five years, been strongly influenced by the principles adopted at Confederation in 1867. The major sources of revenue, customs and excise duties, were placed with the central government, while the provinces were to be dependent largely upon unconditional subsidies, fixed according to estimated minimum budgetary requirements, with no provision for change, either in the scope of governmental functions or in differences among the needs of the individual provinces. Emphasis was laid particularly upon the "finality" of these financial terms and upon "equality" in the treatment of the provinces qua provinces.

It was soon discovered, however, that heterogeneity of geographic and economic factors together with the expanding role of provincial governments, especially in the fields of transportation facilities, education and welfare, necessarily led to dissatisfaction and demands for additional subsidies. These

demands invariably pointed to special concessions based upon fiscal need or adjustments designed to restore the equality of treatment which the concessions had disturbed. The introduction of grants-in-aid during the decade following World War I provided a new kind of financial aid, one made necessary by the lack of balance between provincial responsibilities and financial resources. They did not, however, lead to more satisfactory federal financial arrangements. On the contrary, they brought additional burdens to the provinces and further sources of discord.

Increased federal subsidies and broadened provincial revenue structures were insufficient, during the depression of the 1930's, to prevent the virtual collapse of provincial finances and large-scale aberrations in the "system" of intergovernmental fiscal relations. Having carefully examined the situation, the Royal Commission on Dominion-Provincial Relations recommended strongly, in 1940, that the existing scheme of subsidies be abandoned in favor of a plan designed, through fiscal-need subsidies, to render each province capable of offering a level of public services equal to the national average while not imposing a greater-than-average tax load upon its residents. This plan was found unacceptable, however, and instead, from 1942 to 1947 the provinces, having agreed to discontinue levying personal income and corporation taxes, received large compensatory and, in some cases, fiscal-need subsidies, in addition to the statutory subventions.

With the expiration of this wartime agreement the choice lay between a return to pre-war conditions and a new plan which might be designed to meet the requirements of present-day federalism in Canada. In fact, a compromise agreement was reached with all of the provinces except Quebec and Ontario. The new agreement, having a term of five years, continue the wartime arrangements in principle and retains the emphasis upon essentially equal treatment of the provinces.

Present difficulties indicate clearly that any approach which regards the problem in terms solely of relationships between governments as organic entities is incapable of bringing adequate levels of public services to all Canadians and the achievement of fiscal and economic stability within a framework of federalism. These objectives may be reached only if the position of individuals is made the basis for federal-provincial financial relations. This requires a financial plan under the terms of which the amount and distribution of subsidies would be determined by fiscal need, as measured by the positive difference, if any, between the cost to the province of providing an agreed minimum of governmental services and the revenues that could be obtained through the application of a uniform model tax structure.

Microfilm copy of complete manuscript of 400 pages, \$5.00. Enlargements 6" x 8", 10¢ per page.



**POLITY AND ECONOMY: AN INTERPRETATION  
OF THE PRINCIPLES OF ADAM SMITH**

(Publication No. 3879)

Joseph Cropsey, Ph.D.  
Columbia University, 1952

This thesis attempts to state the premises and general meaning of Adam Smith's economic position by first examining his philosophic doctrine. He is placed in the Hobbean-Spinozistic tradition by reason of his anti-teleological conception of nature; his emphasis upon the desire for self-preservation in explaining all animal life; his concurrence in a mechanistic psychology based upon the idea that the sentiments or passions are sovereign in man; and his development of a moral doctrine oriented upon the equal right of all to life. Generally, the teaching of the Theory of Moral Sentiments is presented as a reaffirmation of certain basic ideas of post-medieval philosophy, especially moral philosophy.

Turning to the teaching of the Wealth of Nations, the question of transforming Smith's philosophy into the principles of an order of society is raised, on two levels: (1) On the theoretical level, commercial society, or the order of endless accumulation, is described as the inference from Smith's emphasis upon self-preservation and its associated passions. (2) On the practical level, the transformation of Smith's principles into an order of society is described as related to his "economic interpretation of history": commerce has been, historically, a potent efficient cause of liberty, or, in other words, a means to the end of freedom. Smith's teaching on this point is drawn from his account of the history of Europe in the Middle Ages, the feudal aspect of which he thought to have been ended by the renaissance of commerce.

The dissertation deals last with Smith's critique of commerce — his well-known reservations against commercial society, most of them founded upon moral considerations: the deterioration of the masses, and the unsatisfactory characteristics of the commercial classes themselves. This is dealt with as the problem of Smith's intentions: criticizing commerce, yet ultimately advocating it, Smith appears as a writer who balanced advantages against shortcomings and then made his affirmative choice for the sake of some overriding end. The hypothesis is offered that Smith was seeking to establish free society on a secular footing, i.e., to dispense with civil and ecclesiastical authoritarianism at once.

Specifically, this possibility amounts to a substitution of the power of man's guided passions ("the invisible hand") for the power of outward authorities.

Concerning the relation of the parts of Smith's writing, the Theory of Moral Sentiments and the Wealth of Nations are affirmed to be in substantial mutual harmony.

Microfilm copy of complete manuscript of 211 pages, \$2.64. Enlargements 6" x 8", 10¢ per page.

**INCIDENCE OF ADVERTISING COST**

(Publication No. 3807)

Ruth Hoffman Engle, Ph.D.  
University of Michigan, 1930

This thesis examines the effect of advertising upon both the supply and the demand sides of the market. The direct impact of advertising on production and marketing costs are first considered with the influence of advertising on demand factors following. Indirect effects of advertising upon economic values such as demand stabilization, standardization, market research, monopoly, and the relation of advertising to the problem of resource allocation complete the study.

The method followed is largely deductive reasoning based on an examination of the literature in the field and on first hand contacts and interviews with men and women engaged in the advertising business. Very limited statistical data could be found.

Major conclusions are summarized below:

1. Advertising often contributes to low production costs. The usual explanation that advertising contributes to larger demand and hence larger scale production is not found universally correct. For some types of goods greater production tends to cause increasing or constant costs. The true explanation appears to be that advertising contributes to lower production costs through stimulating improvements in production.

2. Advertising contributes little toward lower distribution expenses. With increased volume distribution costs tend to rise despite advertising. Any reduction in marketing expense appears to flow from improved methods of distribution. Advertising, however, is a more economical and efficient means of demand creation than any other known method. By use of advertising to promote sales, marketing costs are kept from rising as high as they might otherwise go, which amounts to a relative reduction of marketing expenses.

3. The effect of advertising on demand is two-fold: first, to help educate consumers to a better standard of living; second, and in the opposite direction, to contribute to the growth or more or less pernicious wants. On the whole advertising tends to interfere seriously with consumers' guidance of production.

4. The impact of advertising on the existing economic system is mixed. Advertising is often a potent factor in stabilizing demand, in furthering market research and standardization. But the influence of advertising on competition is problematical. It ranges from encouraging more intelligent competition through better informed buyers to the opposite extreme of creating monopolistic conditions. The arguments are inconclusive on either side. But it seems doubtful that advertising-fostered "monopolies" have in fact achieved very much economic power.

5. Advertising's influence on the allocation of economic resources is also multiple. Justification for directing millions of dollars' worth of production factors into the advertising business may be made on the grounds of increased productive efficiency. It is difficult to defend all the consequences of advertising on resource use since some of the goods and services

produced as a result of or by the aid of advertising do not seem to be socially beneficial.

6. Looking to the future of advertising the conclusion is reached that improvement is to be expected as a result of the natural competitive forces at work in the economy.

Microfilm copy of complete manuscript of 224 pages, \$2.80. Enlargements 6" x 8", 10¢ per page.

#### THE EFFECT OF TRADE ASSOCIATIONS UPON COMPETITION IN SELECTED INDUSTRIES

(Publication No. 3751)

Thomas George Gies, Ph.D.  
University of Michigan, 1952

The purpose of this study is to examine the development and activities of trade associations in a small number of industries, with a view to determining the effect of this institution upon intra-industry competition. The importance of trade associations in the competitive fabric of the economy stems both from their pervasiveness and from the fact that associations, under the guise of legitimate collaboration, provide a mechanism which can be used to effectuate unreasonable restraints upon trade.

Following an introductory section which describes the character and scope of the trade association movement, and the modification of competitive forces which may result from association activities, a critical examination of the work of trade associations in four contrasting competitive situations is undertaken. The first case study, involving the National Association of Retail Druggists, describes the work of an organization operating under conditions approximating monopolistic competition, that is, under conditions where there are numerous firms selling a differentiated product. The two following case studies involving the American Iron and Steel Institute and the principal associations which have operated in the automobile manufacturing industry, represent, respectively, situations approximating oligopoly with homogeneous and with heterogeneous product. The final case study deals with associations in the field of lumber manufacturing, an industry composed of a very large number of firms selling a homogeneous product.

The National Association of Retail Druggists has attempted throughout its fifty-years existence to develop some method for controlling the final price at which drugstore products are sold. However, these efforts achieved little success until the druggists obtained legal support for their scheme. There is some indication that prices and margins in drug retailing have been influenced through the efforts of the N.A.R.D., but the statistical data are incomplete and leave some measure of uncertainty.

Conditions inherent to the supply and demand for steel provide a strong, recurrent tendency toward price cutting by individual firms; such a price cutting, however, is regarded as contrary to the interests of steel producers as a group, and, therefore, deliberate efforts have been made to eliminate all

sources of non-uniformity in steel prices. In these endeavors the American Iron and Steel Institute has played a dual role: it has endeavored to assure the recognition of interdependence among members of the group, and it has supplemented the basing-point system in providing a mechanism for elimination of differences in price.

The record of activities of the two automobile manufacturers' associations examined provides little evidence of price regulation and control of output through collective action. The Association of Licensed Automobile Manufacturers appears to have exercised only a very mild influence in the direction of establishing standards of quality, and the Automobile Manufacturers Association has limited its price control efforts to encouragement of open prices.

It is clear from the record of activities of the three largest associations of lumber manufacturers that organizations of firms in this field have persistently attempted to modify competition in order to curtail output and raise prices. In addition to efforts intended to secure control by voluntary cooperation among firms, organized mill operators have sought intermittently to obtain intervention by government which would grant the right to adopt tactics currently illegal or which would establish government control over prices and production. However, the effectiveness of association plans for voluntary control is open to question, as the present study reveals consistent weakness in programs of price and production control in the lumber manufacturing industry.

Three general conclusions can be drawn from this study. 1) There is likely to be little if any cooperative effort by sellers to control prices where fairly full use of resources can be maintained and where competitive efforts can, through product differentiation, be directed into non-price channels. 2) The existence of economic conditions which encourage price cutting by individual firms frequently leads to voluntary cooperative efforts to maintain prices; in those industries where substantial unused capacity has been periodic or chronic, and where some tendency toward price competition has existed, associations have devoted substantial effort to development of cooperative behavior among members. 3) The success of efforts to regulate prices and production appears to be closely tied to the number of firms in the industry and to the ability of the association to achieve recognition by individual firms of indirect influence.

Microfilm copy of complete manuscript of 390 pages, \$4.88. Enlargements 6" x 8", 10¢ per page.

#### THE COMPETITIVE POSITION OF THE MINNESOTA SOYBEAN PRODUCER AND PROCESSOR

(Publication No. 3944)

Ray Allan Goldberg, Ph.D.  
University of Minnesota, 1952

#### The Producer

One of the major hypotheses of the thesis was as follows:



Minnesota has a comparative advantage in the production of soybeans, and in consequence soybeans can compete effectively with other farm enterprises.

In general, the analysis presented in this thesis has tended to confirm this hypothesis. The facts which support this conclusion and which have been effective in accounting for the twofold increase in soybean production in Minnesota during the last five years are as follows:

(1) The net income per acre of soybeans is relatively higher than that of any other crop with the exception of corn.

(2) The development of new varieties of soybeans that are more adaptable to the present growing area in southern Minnesota and new varieties that can be used in other areas of the state will enhance the comparative advantage of the crop in the state.

(3) The producer in Minnesota has excellent present markets for his soybean production by virtue of the expanding market of the Minnesota and northern Iowa processing industry, and the potential export market in Canada.

(4) The study of 50 farms in southern Minnesota indicates both an increase in the number of farms producing soybeans and an expansion in soybean acreage by established soybean farmers.

However, there are certain economic conditions that may limit the expansion of the soybean crop in Minnesota.

(1) The weakened export and edible oil markets for soybeans and soybean oil, that are partially offset by the use of E.C. A. funds and the excellent demand for soybean meal, indicate that the rate of expansion of soybean crop in all states will be more moderate.

(2) The study of 50 southern Minnesota farms indicate that the soybean crop is not yet a permanent part of the Minnesota farmer's crop rotation program.

In conclusion, the factors supporting the continued expansion of the soybean crop in Minnesota are much stronger than the limiting conditions. Taking all factors together, one may conclude that soybean production will continue to increase in Minnesota but at a declining rate.

#### The Processor

The second major hypothesis of the thesis was as follows:

The processing industry in Minnesota possesses a highly favorable comparative advantage in relation to the processing industries located in the other principal processing states, and in consequence can compete effectively with the latter.

The subsequent analysis confirms this hypothesis. The factors which support this conclusion are the location advantages of the Minnesota processor. These advantages are twofold:

(1) The Decatur plus freight sales of meal within the state or to Western States and Canada; and

(2) the Chicago minus freight purchase of Minnesota soybeans.

The conditions necessary for the maximization of the transportation advantages are present in Minnesota. These conditions are:

(1) A plentiful local supply of soybeans;  
(2) an excellent state soybean meal market; and  
(3) adequate storage facilities at processing plants to permit the processor to acquire local soybeans at the time of crop movement.

The adverse conditions of the Minnesota location include the following:

(1) the low oil content of soybeans;  
(2) the transportation cost of shipping soybean oil to eastern markets on a Decatur freight basis;  
(3) the restricted area to which the meal transportation advantage applies; and  
(4) the temporary disadvantage of the Minnesota location if ceiling prices on soybeans become operative and are not based on the normal price differentials of soybeans between Minnesota and the other principal soybean producing states.

In conclusion, the rapid growth of the processing industry in the United States has created an over-capacity situation. The maturing of this industry is now taking place and some contraction is feasible. At the same time, expansion in favorable locations such as Minnesota will probably continue to take place slower than that of the last few years.

Microfilm copy of complete manuscript of 284 pages, \$3.55. Enlargements 6" x 8", 10¢ per page.

#### STATE BANKS AND THE ECONOMIC DEVELOPMENT OF THE WEST, 1830-44

(Publication No. 3887)

Carter Harry Golembe, Ph.D.  
Columbia University, 1952

This study is primarily an investigation of the relationship between the early western banks and the economic development of the West during the years 1830-44. It was in this period that the West - comprising at that time the states of Ohio, Indiana, Illinois and Michigan and the Wisconsin territory - enjoyed years of particularly rapid economic advance (1834-39) before a long and severe depression, (1840-43).

The regular banking systems of Ohio and Wisconsin were composed of privately owned, state chartered banks. In both places part of the banking business was also handled by unauthorized banks. In Illinois and Indiana banking was largely done by a few large institutions, partially owned and controlled by the state governments. Banking in Michigan resembled that of Ohio and Wisconsin until 1837, when a General Banking Act permitted the establishment of "free" banks. For the area as a whole, the banks commonly thought of as "Wildcats" were most numerous in crisis or depression years, rather than in the boom years 1834-36.

Western banks in this period were banks of issue; i.e., their major obligation to the public was in the form of circulating notes. Although the banks have been criticized for unorthodox banking practices, such practices reflected: 1) attempts to protect the specie reserve in an area where specie was particularly scarce, 2) the necessity of securing a normal return

for investors and, 3) the fact that banking was a political issue of major importance.

Bank loans to the business community went largely to individuals connected directly or indirectly with the export trade. This was especially true in the case of the Cincinnati banks and the State Bank of Indiana. Often produce could not be exported in the absence of such loans. It is estimated that at least 20 per cent of bank assets were in the form of business paper.

Probably the largest loans went to land speculators. These funds were used to purchase land and, more important, to make real improvements so as to attract settlers to the area. Settlement of the West in this period was most rapid in the years 1834-37, suggesting that the speculative land boom of the same years was not a deterrent but rather an important factor in attracting settlers.

Bank loans to internal improvement agencies were probably of less importance, quantitatively, than those to businessmen or speculators. Most of these loans were made in the years 1839-41. Nevertheless, many projects could not have been started, nor could some have been completed without bank aid.

Turning from loans to individual borrowers to the over-all effect of bank lending, it is clear that western capital formation depended upon the securing of resources from the west and the maintenance of a large import surplus. The banks were important in both movements: by placing new currency issues in the hands of entrepreneurs they made possible the diversion of resources and labor into investment projects; by helping to attract funds from the East, especially for investment in the banks and in land, they contributed to the financing of the import surplus.

It is concluded that in assisting to finance western capital formation the banks were guilty of violating the canons of sound commercial banking. Justification for their actions lies in the fact that they helped make possible a rate of growth and development which changed the West from a primitive agricultural area to a highly productive region in a remarkably short time.

Microfilm copy of complete manuscript of 497 pages, \$6.21. Enlargements 6" x 8", 10¢ per page.

#### **PUBLIC POOR RELIEF IN AMERICA, 1790-1860**

(Publication No. 3686)

Benjamin Joseph Klebaner, Ph.D.  
Columbia University, 1952

This study describes American public relief practices and the philosophy which motivated them. Only the seaboard states from Maine through Georgia are covered. As these had the bulk of poverty in the country, and the newer states and territories imitated those on the Atlantic, a picture representative for the country as a whole is obtained. Wherever possible, manuscript and other primary materials of the period 1790 to 1860 have been used to illustrate

the actual working of the poor laws; the laws themselves are traced to their colonial and English origins.

We begin with the explanations of poverty then prevalent; most of these concerned the moral failings of the poor. Some writers discussed the expediency of eliminating the poor laws. No state did abolish public relief, but a trend to almshouse care gained impetus in the early 1800's, with the result that almost every sizeable (and many small) communities had a poor farm by 1860. The poorhouse was supposed to furnish paupers with a shelter, and a place where they would labor for the profit of the locality. Despite the insistence that the inmates labor, however, few institutions could get much work out of the paupers, who were for the most part aged or infirm.

Outdoor relief was given not only in localities which never acquired almshouses but also in places with poor farms. Generally upon the acquisition of an institution, a community would resolve to furnish only indoor relief, but as a rule the principle broke down after a time. Paupers would be assisted at their homes or the house of a person willing to keep them. Relief might be a trifle in cash or fuel, or as much as complete maintenance. Many localities, particularly before the 1840's, auctioned the care of their poor to the lowest bidder.

Settlement provisions rivalled the English law in their complexity. Removal of paupers (and occasionally also of persons who it was feared would become public charges) often formed a considerable part of total poor expenditures. Overseers of the poor would assist paupers who wished to move away from their place of residence, while persons who were travelling about (not only vagrants) would be given a night's lodging, a meal, and perhaps a few cents to send them on. In Massachusetts and South Carolina the state participated in the cost of aiding the non-settled poor. For the most part, however, relief was the function of the town in New England, the county in the South, and a mixture of the two in the Middle Atlantic States. Manumission laws did not allow masters to rid themselves of the burden of supporting aged or infirm slaves.

Immigration legislation during the colonial period sought to protect the community from foreigners likely to become chargeable by requiring the vessel master to carry them back or post bond. In the important maritime states this evolved into provisions requiring all foreign passengers to pay a head tax, in the early nineteenth century. Special facilities for the medical treatment and relief of immigrants were provided in New York City and Boston. Elsewhere, traditional poor law relief procedures were used. Foreign-born persons were a disproportionate part of the pauper class, but the oft-levelled accusation that European governments were systematically dumping their pauper hordes here was a gross exaggeration.

During the severe depression of 1857 many northeastern cities made extensive use of public works to give jobs to the unemployed. Most of the needy, however, were assisted in the traditional manner. The heritage of the period under study is not so much any specific relief techniques, as the principle of government as almoner.

Microfilm copy of complete manuscript of 725 pages, \$9.06. Enlargements 6" x 8", 10¢ per page.



**POST WAR PRICE DETERMINATION  
IN THE WISCONSIN CANNING INDUSTRY:  
THEORY AND PRACTICE**

(Publication No. 3954)

Charles Williams Miller, Ph.D.  
University of Minnesota, 1952

This study is an endeavor to add to a better understanding of the problem of price determination by an investigation of the pricing methods and practices, the optimum size, and the objective verification or non-application of price theory in the Wisconsin canning industry.

The methods used by the canners in pricing and other correlative operational practices were obtained by personal interviews and conferences with every pea canner in Wisconsin. All the financial data used was gathered from the income tax returns of eighty-two Wisconsin canning corporations for the crop years of 1946 through 1951. The production figures exhibited were made available by the Wisconsin Canning Association. The findings then were compared with the prevailing price theories for a possible synthesis.

Their results were mixed. The optimum sized farm in the Wisconsin canning industry was on the average the middle sized enterprise. The financial success, however, of the most outstanding firm of each group seemed to transcend the concept of any single best size.

In the comparison of practice with theory there seemed to be good identification of the manager owner of the business with Marshall's theoretical concept of the entrepreneur. Profit maximization, subject only to minor limitations, appeared to be as in theory the motivation of the management. There was evidence too that the understanding of the complexity of the market structure was made easier by the Chamberlinian imagery.

On the other hand, the actual market knowledge particularly of the estimated demand and supply prices fell far short of the theoretical assumptions. Product differentiation in one form or another was undertaken by all firms to alter the market in their favor. On the average, however, heavy expenditures on selling cost for this purpose failed to bring the quasi-monopolistic profits pictured in theory.

The peculiarities of production and the inherent riskiness of the canning industry seemed to have been barren ground for marginal and full cost pricing theories. There was little evidence of either in the practices of the canners. As a whole they followed no single method or theory of pricing. Elements of all were traceable in their practices including man's age old propensity to truck and barter. The simplicity and preciseness of the theoretical explanation of prices determination did not coincide with the complexities and varieties of the canners' practices.

A priori prediction of future prices on the competitive portion of the canner's pack lacked accuracy and within a meaningful and useful range was indeterminate.

The lack of a workable explanation of the complex

price relationships appeared to be caused not by ignorance of their existence but by the lack of knowledge as to their evaluation with the present state of arts. Actually not even approximate truth or understanding of the basic economic concept of price can be reached without both the theoretical and practical knowledge of the industry and environment in which it operates, one buttressing and confirming the other.

Microfilm copy of complete manuscript of 107 pages, \$1.34. Enlargements 6" x 8", 10¢ per page.

**THE DEVELOPMENT OF CENTRAL BANKING  
IN ITALY: A STUDY OF STRUCTURAL GROWTH  
AND CREDIT CONTROL**

(Publication No. 3917)

Anthony Louis Sancetta, Ph.D.  
Columbia University, 1952

The political unification of the kingdom of Italy, in 1861, did not wipe out the parochial attitudes of the Italians which had been ingrained by centuries of despotic local rule. Because of this spirit of regionalism, the formation of a central bank was not achieved until 1926, after the Fascists had come to power.

There were six banks of issue in Italy until 1893. In that year they were reduced to three in number: the Banca d'Italia, the Bank of Naples and the Bank of Sicily. The Banca d'Italia, became the sole bank of issue in 1926. In the same year, the Decree Law of September 7, 1926 brought the banking system under the supervision and control of the Banca d'Italia. As Fascism turned toward economic nationalism, in the 1930's, the growing economic activities of the State resulted in the Bank Act of 1936 which placed the money generating powers of the Banca d'Italia under the complete control of the Government. The return to a democratic form of government after World War II did not materially alter the structure which had developed up to that time.

The development of central bank policy falls into three distinct phases. The first phase covers the period 1894-1934. During this period the policies of the Banca d'Italia developed into those of money market control and maintenance of exchange rate stability by relying on bank rate variations to bring about the desired adjustments. Beginning with the year 1935, a fundamental change in policy became evident. The Banca d'Italia was obliged to adapt its activities and policies to conform with the principles of a controlled economy and was no longer free to determine the direction and flow of money and credit independently from government dictation. This was also the beginning of a policy of controlled inflation which the central bank was unable to avoid, being determined by the imperialistic adventures of the government and the program of self-sufficiency. The third phase was ushered in with the fall of Fascism and the return to a democratic form of government after World War II. The Banca d'Italia came

under the leadership of Luigi Einaudi, later president of the Italian Republic, who inaugurated a central bank policy which has operated within the framework of a liberal economy.

The problem of credit control in Italy is complicated by the fact that the Italian economy is characterized by a structural imbalance among the factors of production, chronic unemployment of labor, low rate of capital formation, and heavy dependence on foreign trade for raw materials and foodstuffs. With respect to the balance of payments, Italy's long-run status has been that of a debtor country. Monetary policy alone cannot promote the full employment of labor resources since the defect is structural. With respect to domestic economic stability, the Banca d'Italia cannot pursue an independent course since the Italian economy is exposed to the influence of external forces over which Italy has no control. Nevertheless, it is in Italy's interests that, for the long run, the Banca d'Italia should follow a policy of mild deflation as the best means of insuring monetary stability.

Microfilm copy of complete manuscript of 305 pages, \$3.81. Enlargements 6" x 8", 10¢ per page.

#### MANPOWER RESOURCES IN A TIGHT LABOR MARKET

(Publication No. 3960)

Kenneth Edward Schnelle, Ph.D.  
University of Minnesota, 1952

The objectives of this study are two. First, it is desired to describe that segment of the population which seems physically able to work but which is not working and not seeking work. In that description, one wishes to know the abilities of people to assist in producing goods and services in times of national emergency. Second, it is desired to determine the conditions under which these people will accept employment.

To these ends, a 1% sample survey was conducted in the city of St. Paul. The sample was drawn on a residential unit basis, and all members of selected households were included in the study. A so-called household schedule was used to record age, sex, household relationship, and employment status for each person in residence. An interview schedule was used to record detailed historical and attitudinal data for physically fit, adult, non-labor-force people.

Survey results were first compared with 1950 Census data, and on the basis of this comparison, it was concluded that sampling procedures were adequate. Next, the data for both employed and unemployed members of the labor force was inspected, and a large number of statistically reliable relationships among descriptive characteristics were discovered. Third, the data for non-labor-force people was inspected both for statistically reliable relationships and for expressions of reasons for not working, reasons for wanting to work, and conditions under which people would work.

It was found that, on October 15, 1951, two-thirds of the physically fit, adult population were in the labor force. 76% of those not in the labor force were housekeeping females, 17% were school-attending youths, and 4% were retired males over age 65.

For the non-labor-force population, eight significant reasons for wanting to work were recorded. Of these, the most important were: to earn money and to get out of the home. Twenty-six significant reasons for not wanting to work were discovered. Of these, the most numerous were: need to care for children, too busy at home, too busy with school, not well enough, don't need the money, too old, don't think I could get a job, and household member objects to my working. Twenty-eight significant conditions under which people would work were listed. Of these, the most frequent were: If my husband were disabled, if I needed money, if I could get part-time work, none, national emergency, particular hours, particular job, adequate child care, and when children get older.

A somewhat unusual procedure was used for the discovery of associations among labor market characteristics. A cell-by-cell inspection was made of diverse distributions of the data. Comparisons were made between observed and null-relationship frequencies to determine whether significant differences existed. Less than 1 in 100 significant differences could occur by chance, but in fact, a much larger number were observed. Such differences imply associations among the simultaneous distributions studied. The observed relationships are catalogued in the summary of results.

The study confirms belief that there are supplies of labor rather than a supply of labor. It shows that different segments of the aggregate supply have different characteristics and that they have differential behavior patterns to various stimuli. It indicates the relative importance of diverse incentives, disincentives, and conditions of employment of non-labor-force people in a tight labor market. It demonstrates that, in the tight labor-market studied, the limit of labor force expansibility has not been reached, and it recommends actions to be taken to further increase labor force participation.

Microfilm copy of complete manuscript of 283 pages, \$3.54. Enlargements 6" x 8", 10¢ per page.

#### ALTERNATIVE MONETARY INTEREST THEORIES: A COMPARISON AND EVALUATION

(Publication No. 3804)

Warren Lounsbury Smith, Ph.D.  
University of Michigan, 1952

The purpose of this study is to make a comparative dynamic analysis of the two most commonly employed theories of the interest rate level: the liquidity preference theory of J. M. Keynes, and the loanable funds theory as expounded by G. Haberler, D. H. Robertson, and others. Macrodynamical models are set up embodying each of the two theories. Analysis of these models leads to the following major conclusions:



(1) The two theories do not differ in any important way with respect to the factors taken into account as determinants of the interest rate. Savings, investment, the demand for idle balances and the supply of money all have direct influence on the interest rate in both theories.

(2) The important difference between the two theories relates to the use of stock and flow analysis. The liquidity preference theory regards investors as desiring to hold a certain stock of idle money, the size of which depends upon the rate of interest. The loanable funds theory regards them as desiring to change their stock of idle balances at a certain rate which depends upon the rate of interest. The concepts of the supply of and demand for money employed are thus different: the liquidity preference theory uses the stock of money and the stock of idle balances, while the loanable funds theory uses the change in the stock of money and the change in idle balances.

Due to the difference between stock and flow analysis, the two theories have considerably different implications for monetary theory and policy. For example, according to the liquidity preference theory, a change in the stock of money may permanently change the interest rate and the level of income, while, according to the loanable funds theory, a change in the rate of flow of money into or out of the system is required to effect such a permanent change. The two theories are also shown to have somewhat different implications with respect to the relation between monetary and fiscal policies.

It is demonstrated that the interest rate performs a role in the process of reaching an equilibrium level of income under either theory. Knut Wicksell's theory of interest is shown to be a special case of either the liquidity preference or the loanable funds theory.

In the final chapter, it is maintained that in an economy whose wealth is increasing, investors would presumably attempt to keep their idle money balances in some proportion to their total wealth, the proportion depending on the interest rate. This means that they would normally be adding continuously to their money balances. Under these circumstances, the loanable funds theory, which treats the monetary variables as flows, is the more appropriate theory.

Microfilm copy of complete manuscript of 237 pages, \$2.96. Enlargements 6" x 8", 10¢ per page.

#### THE NEW ORLEANS-HOUSTON PORT RIVALRY

(Publication No. 3921)

Earl Charles Thibodeaux, Ph.D.  
Columbia University, 1952

New Orleans encountered very effective competition from North Atlantic ports early in its history. As the currents of commerce shifted to their present east-west direction with the construction of canals and railroads, New York gained considerably

at the expense of New Orleans. The latter belatedly tried to regain the fugitive trade by improving conditions at the port, but the North Atlantic ports now had the advantage of being located on the main trade route — that between Europe and Northern United States. The improvements made at New Orleans enabled that port to meet the competition of the newer Gulf Ports more successfully, primarily because the former has a large advantage in its low-cost north-south transportation on the Mississippi River, and those low water transportation rates keep competitive rail rates down.

Houston, Texas, is at present the largest port on the Gulf of Mexico in terms of total tonnage of waterborne trade. The selling efforts exerted by the various Houston interests, individuals, and public and private organizations, might lead one to the conclusion that that port is in close competition with New Orleans. An analysis of the trade statistics reveals that the two ports are largely engaged in rendering different services to different shippers, Houston apparently not having succeeded in appreciably extending its hinterland at the expense of New Orleans. Houston is primarily an export port, an outlet for goods that are produced within the State of Texas, whereas New Orleans handles an almost equal amount of goods in-bound and out-bound. The exports from the latter consist of a variety of goods which originate at numerous points in the Mid-Continent area, and the imports are largely destined to those up-river points. Over 85 percent of Houston's waterborne trade consists of petroleum products, wheat, and local movements of sea shells, most of which cannot be considered to be competitive traffic.

In the industrial sphere Houston and the State of Texas have made tremendous advances in recent years, especially in those industries that use natural gas and petroleum. Those manufacturing industries contribute significantly to the tonnages moving through the port of Houston, but at the same time greatly increase the rate of consumption of those local wasting resources. Houston's present prosperity is due primarily to its local oil resources. Although it is impossible to predict the duration of such resources, it is probable that they will be exhausted within a relatively few years. Houston's ability to maintain her position as the leading port on the Gulf will then depend upon how well that area develops the other local resources. The resources and leadership are apparently available, but it is doubtful whether the more prosaic industries can continue to entice the large population and finances that have moved into the production and processing of petroleum and petrochemicals.

At New Orleans the position of the port appears relatively secure as long as the Mississippi River remains an important artery of commerce linking the complex manufacturing and agricultural sections of the interior of the United States with world markets and sources of raw materials. Basic changes in the means of transportation or changes in transportation costs could conceivably lessen the importance of New Orleans as a port, but for the present the National Government is committed to the maintenance of a

healthy rivalry among the existing means of transportation internally. That has required and will probably continue to require large-scale expenditures by Governmental agencies to insure the navigability of the internal waterways. Thus subsidized, New Orleans will continue to be the most economical outlet on the Gulf for the Mid-Continent area as well as for its local hinterland.

Microfilm copy of complete manuscript of 217 pages, \$2.71. Enlargements 6" x 8", 10¢ per page.

#### ATOMIC ENERGY CONTROL AND PROMOTION

(Publication No. 3811)

Richard Alton Tybout, Ph.D.  
University of Michigan, 1952

The dissertation gives primary attention to the main currents in the United States domestic atomic energy policy as related to control, or the protection of the public interest, and promotion, or the creation of conditions for economic progress. A fundamental conflict between control and promotion exists in statutory policy and also in administrative policy under the United States Atomic Energy Commission.

Domestic statutory control policy is studied by comparison with considerations applicable to international control. Material on the latter topic is presented in Part I and a comparative study of domestic and international control considerations is made in Part II. This comparative study provides the principal basis for the conclusion that insofar as the safeguarding of the public interest is concerned, domestic control policy is unnecessarily restrictive in requiring Government ownership of fissionable materials and the facilities for their production. The conclusion is supported in Part III by reference to the control policies employed by the United States Atomic Energy Commission.

Promotional aspects of domestic statutory policy are analyzed in Part II by reference to economic principles and the application of such principles in the fields of invention, anti-trust policy, and patent reform, fields covered by statutory promotional measures. The conclusion is reached that the promotional aspects of statutory policy are in conformity with widely accepted notions regarding desirable economic policy in general, but are compromised by statutory control policy.

A further analysis of control and promotional policy is made in Part III by reference to the administrative practices of the Atomic Energy Commission. These practices refer in particular to the operation of Government owned facilities by private contractors. The study of both control and promotional policy is organized on the basis of certain aspects of entrepreneurship, including the introduction of new production functions and the control of costs of materials and labor. Comparative standards for judgment of the practices of the Atomic Energy Commission are drawn from experiences in war contracting. Comparative standards relating

to the operating performance of private contractors are obtained by reference to accepted concepts of entrepreneurial behavior in private enterprise. Much of the factual knowledge of activities in the atomic energy program has been obtained by the author through field studies. It is found that a number of restrictions on promotion arise from the circumstances of defense production. The general conclusion is reached that the promotion of atomic energy is restricted more significantly by certain requirements of production for military needs than by statutory requirements for control, though the elimination of the requirement for Government-ownership of fissionable materials and the facilities for their production would be desirable from the immediate standpoint in certain small, but potentially significant, areas and might be of great long run importance.

Microfilm copy of complete manuscript of 617 pages, \$7.71. Enlargements 6" x 8", 10¢ per page.

#### PUBLIC REGULATION OF THE FLUID-MILK INDUSTRY IN DETROIT, MICHIGAN

(Publication No. 3816)

Jared Scudder Wend, Ph.D.  
University of Michigan, 1952

The purpose of this study is to examine the reasons why public regulation of fluid-milk prices has been undertaken from time to time in Detroit, how successfully the objectives have been attained, and how fully the public interest has been served. The milk industry displays economic peculiarities, both on the supply and on the demand side, which underlie these regulative efforts and require careful examination in appraising them. The organization of the study is primarily historical; alternate periods with and without regulation permit an examination of the forces involved and an appraisal of the results achieved.

In the First World War the Governor of Michigan created the Detroit Milk Commission, which fixed producers' and retail milk prices to insure an adequate milk supply at reasonable prices. During the Second World War the federal government fixed retail milk prices as part of the general price control program and paid the producers subsidies to promote adequate production. Both programs were generally successful.

Competition from new distributors and from producers who previously had sold their milk to manufacturing plants led, in 1933, to the establishment by the Agricultural Adjustment Administration of market-agreement and license arrangements that fixed retail and producers' prices and limited the area from which milk could be shipped to Detroit, with the aims of increasing producers' prices and restricting retail competition. In 1934 the area limitations and fixed retail prices were discarded when the new market license was substituted. The controls succeeded in increasing producers' prices somewhat, but doubts about the constitutionality of federal regulation where commerce was primarily intrastate caused the administration to



end control in 1937. Renewed competition by distributors who paid producers less than the prevailing prices led to state control in 1939, but it was declared unconstitutional in 1941. A second state control law was defeated by a referendum vote in 1942. Continued competition after the war, coupled with an increase in interstate commerce in milk in the area, resulted in a federal marketing order in 1951. This order required distributors to pay producers prices based on the prices of manufactured milk products and on the percentage of the milk shipped to the market that was sold in fluid form.

Public regulation of fluid-milk prices in Detroit in the 1930's and 1951 was undertaken to increase producers' prices. The methods used were unsuccessful, for the most part, because higher fluid-milk prices led to increased shipments, with the result that more milk had to be manufactured and the average prices received by the producers remained near the competitive levels. In the absence of regulation the consumers would have had an adequate supply of fluid milk at lower prices and the producers would have been little, if any, worse off.

The conclusion to be drawn from this study is that unregulated competition, coupled with vigorous enforcement of the anti-trust laws, would be superior to any of the methods of regulation yet tried in Detroit.

Microfilm copy of complete manuscript of 250 pages, \$3.13. Enlargements 6" x 8", 10¢ per page.

## EDUCATION

### THE DEVELOPMENT AND UTILIZATION OF THE HIGH SCHOOL EQUIVALENCY CERTIFICATE IN MISSOURI

(Publication No. 3828)

Neil Clay Aslin, Ed.D.  
University of Missouri, 1952

This investigation attempted to trace the development and to describe the utilization of the High School Equivalency Certificate in Missouri. A survey of the practices in other states relating to this problem was also made.

The specific purposes of the study were:

1. To record in detail the development of the High School Equivalency Certificate in Missouri.
2. To survey the general practices relative to the issuance of the High School Equivalency Certificate in the forty-eight states.
3. To study the characteristics of the applicants for the High School Equivalency Certificate in Missouri.
4. To determine the reasons why Missouri applicants wanted the High School Equivalency Certificate.
5. To find the uses which had been made of the High School Equivalency Certificate in Missouri.
6. To determine the reasons why the applicants for the High School Equivalency Certificate in Missouri left school before graduating from high school.

The data for this study were secured from the following sources:

1. Questionnaires were submitted to the forty-eight chief state school officers relative to the High School Equivalency practices in their states.

2. Questionnaires were submitted to the candidates for the Missouri High School Equivalency Certificate relative to the reasons why these candidates wanted the Certificate and what uses they had made of the Certificate.

3. The applications provided a source of data relative to the characteristics of the candidates. These applications gave the reasons why the applicants had left school before graduating from high school.

4. The GED test scores of Missouri candidates for the High School Equivalency Certificate were used.

5. Related studies published by the American Council on Education, the National Association of Secondary School Principals, and the U.S. Office of Education provided helpful sources of information.

6. Interviews with members of the Missouri State Department of Education who are presently charged with the responsibility for administering the High School Equivalency Certification program provided needed information.

These data were analyzed and presented under seven major divisions, namely: the history and development of the Equivalency Certificate in Missouri; the High School Equivalency Certificate in other states; the characteristics of the applicants for the High School Equivalency Certificate in Missouri; why they wanted the Equivalency Certificate; why they left school; and summary, conclusions and recommendations based upon the findings of the study.

Some of the pertinent findings of the study were as follows:

1. There seemed to be a definite need for some means of evaluating out-of-school educational experience in terms of high school credit.

2. The High School Equivalency Certificate has become quite popular. Thirty-four State Departments of Education have issued 97,992 of these Certificates.

3. The GED test has become widely accepted as a measure of adult educational experience. Forty-four State Departments of Education recognize the GED test as a basis for establishing school credit.

4. There seems to be some evidence to indicate that the High School Equivalency Certification program, which started as a post-war measure, may be continued indefinitely. Only one state, Kansas, has discontinued the program and thirty-five chief state school officers expressed the belief that there continues to be a need for the High School Equivalency Certificate.

5. Candidates for the Missouri High School Equivalency Certificate indicated that they believed the program should be continued in this state.

6. The candidates for the Missouri High School Equivalency Certificate made higher average scores on the GED test than the last semester high school seniors on which the test was standardized.

7. Most candidates wanted the Missouri High School Equivalency Certificate for vocational purposes.

8. The psychological advantage which the recipients of the Missouri High School Equivalency Certificate have gained seems to be an important reason for continuing the program.

9. Many of the recipients of the Certificate in Missouri have used it to gain admission to schools and colleges.

10. The Missouri High School Equivalency Certificate has been generally accepted in lieu of the high school diploma.

11. A total of 2,076 Certificates have been issued by the Missouri State Department of Education.

12. A total of 640 or 23.5 per cent of the candidates for the Certificate in Missouri have failed to make a passing score on the GED test.

Microfilm copy of complete manuscript of 258 pages, \$3.23. Enlargements 6" x 8", 10¢ per page.

#### IMMATURE EGO DEVELOPMENT AS A FACTOR IN RETARDED ABILITY TO READ

(Publication No. 3711)

Lucille Knecht Barber, Ph.D.  
University of Michigan, 1952

Twenty-three retarded readers from six elementary schools were studied intensively to determine (1) whether a common personality pattern could be established; and if so (2) to describe the nature of this common pattern. The hypothesis which guided the study was that growth is a biological unity of which emotional and social growth are integral parts. Reading was thus regarded as one aspect of learned social growth, and was presumed to proceed in congruence with other specific aspects of emotional and social growth. Ego strength was defined as ability to gauge reality and synthesize behavior in appropriate goal directed activities adequate for chronological age.

Data secured included cumulative school journal records, health and organismic age status, individually administered intelligence tests, and interviews with teachers, children and parents. Where records were available data were secured from visiting teachers and child guidance clinics. A battery of personality projection tests, including Rorschachs, Bender Visual-Motor Gestalt tests and Goodenough drawings, interpreted according to the Machover criteria, was administered. These materials were assembled into a case history of each child and evaluated as a diagnostic study. Records were tabulated to show both current status and the child's pattern of development prior to this study. Behavior at home, in school, in the interview situation and projective test productions were discussed in relation to each other and correlated with rate of physical growth. The focus of the study was upon the child's adaptation to his environment rather than upon specific factors within his environment.

For each child a personality immaturity, designated in this study as immature ego development, was found to be sufficiently marked to cause serious difficulty for the child in competition with children

of the same age with more adequate social and emotional maturity. This immaturity was found in all aspects of the child's life and in his projective test productions. Anxiety about himself and his relationships with people was found in each child, was considered to pre-exist school entrance and to be based in family relationships. In each instance the child was involved in a family intrarelationship which held him to belated preoccupation with preschool adjustment problems. While no two family situations were sufficiently alike to make it valid to indicate a specific family structure or relationship as associated with retarded reading growth, when families deviating from normal biparental structure and/or function and families affected by status insecurity were considered together, all but six of the children were included.

A correlation of .46 was found between organismic growth status and reading achievement status for the 21 boys in the group suggesting a maturational explanation working differentially even within this restricted group.

Findings indicate a lag in maturation in each child in all areas of behavior. There was an essential insecurity in his perception of himself in relation to other people. Anxiety bound him to preschool family relationships and hampered his ability to differentiate himself from others. Lag in differentiation of self was expressed in definite socio-personal goals appropriate to a younger child. Immature personal goals absorb much growth potential, disrupt school adjustment and make learning of reading slower for the emotionally immature child than for the child whose emotional growth is appropriate for his years.

Microfilm copy of complete manuscript of 440 pages, \$5.50. Enlargements 6" x 8", 10¢ per page.

#### AN EXPERIMENTAL STUDY TO DETERMINE THE EFFECTIVENESS OF TWO DIFFERENT METHODS OF TEACHING TENNIS

(Publication No. 3714)

Lua Stewart Bartley, Ph.D.  
University of Michigan, 1952

The purpose of this study is to determine the difference in the amount of learning in tennis between two equivalent groups of college women when two different teaching methods are used. One method provides all instruction on the tennis courts; the other method makes use of the classroom and tennis courts on alternate class meeting days.

The experimental method was employed in this investigation. Three groups of college women comprising two experimental and one control, each consisting of twenty-four students, were equated on the basis of initial scores on the Dyer Backboard Test of Tennis Ability. They were checked for similarities with regard to age, height, weight, preference for twelve physical education activities, and previous participation in eight sports. The teaching content was based on specific objectives considered essential for a beginners' course in tennis by 112 experienced



physical education teachers in 43 colleges located in 22 states. Methods, progressions, equipment, and tests used were selected after a trial period of teaching. The experiment was conducted under regular class conditions and was limited to college women who were beginners in tennis.

The experimental teaching consumed twenty one-hour lessons and extended over a period of ten weeks. The independent variable in the two methods was the amount of time spent in actual practice and in discussion of the content taught. The control group received no instruction and played no tennis during the experimental period.

The data are the initial and final scores as determined by objective tests and subjective judgments of a selected jury. The amount of learning is measured in terms of the difference between initial and final scores made on four skill tests and one knowledge test. Means, standard deviations, and *t*-ratios are employed in the intercomparisons of the groups. Correlation coefficients are used to determine the agreement of the judges in their ratings of form, the relationship between accuracy and form, the relationship between skills and knowledge, and re-test reliabilities.

No significant differences are found between the two experimental groups in their mean final scores or mean gains on any test, but significant differences below the 1 percent level of confidence are found between both experimental groups and the control group on all tests. There is constant overlapping of individual scores within and between the groups which received instruction. Preference for tennis or previous participation in other sports seems not to influence the amount of learning.

The results of this analysis show that achievement in tennis skills and knowledge is not influenced by the relative amount of time spent on the courts in practicing the skills or by the relative amount of time spent in discussing the game in the classroom situation and that there are wide individual differences among students in their responses to the two different teaching methods.

The general conclusion is that there is no significant difference in the amount of learning that takes place when the two different methods of teaching employed in this study are used.

Microfilm copy of complete manuscript of 224 pages, \$2.80. Enlargements 6" x 8", 10¢ per page.

# DETERMINING VALIDITY OF THE INCOMPLETE SENTENCES BLANK THROUGH APPRAISAL OF QUALITATIVE INTERPRETATIONS

(Publication No. 3829)

Wilbert Arthur Berg, Ed.D.  
University of Missouri, 1952

## Purpose

The purpose of this study was to determine whether or not The Rotter Incomplete Sentences Blank revealed sufficient information to permit the

investigator to discover and understand the needs, attitudes, aspirations and adjustment difficulties of the high school student. The purpose of the study was, furthermore, to determine whether the investigator could draw valid conclusions concerning the manner in which these needs, attitudes, aspirations and adjustment difficulties were reflected in behavior. The following questions were posed by the problem and clarified the purpose of the study.

1. Does a critical examination of students' Incomplete Sentences Blanks reveal significant features of students' personalities to the examiner?
2. Can the examiner interpret the responses of students without knowledge of the identity of the students and accurately describe the students' behavior?
3. Can the examiner's description of students' behavior be confirmed as an accurate description by teachers who have observed the students in the classroom?

## Method of Research

The study group consisted of 48 sophomore and junior students enrolled in the University of Missouri Laboratory School. The Incomplete Sentences Blank was administered to the study group. Without knowledge of students' identity, an interpretative description was written by the investigator from every test paper. Qualified judges rated the descriptions independently on the basis of the accuracy of interpretation. Teachers were requested to estimate the identity of students from the interpretations and to rate the interpretations as verbal pictures of students' behavior after students' identities had been revealed.

## Summary

According to a composite rating of the judges, 96 per cent of the interpretations were reasonably accurate. There was a very substantial degree of inter-judge agreement in the assignment of independent ratings.

Teachers attempted to estimate the identity of students from the descriptions according to a method which was designed to minimize the chance probability of identification. The success of the teachers in identifying students from the descriptions was evaluated by a comparison between the number identified and the chance probability of identification. The determination of chance probability was computed from the binomial expansion. The probabilities of individual teachers' identifications varied from those significant at the .01 level to those significant well above the .05 level. An analysis of group success in identification revealed that twenty-eight, or 58 per cent of the descriptions were identified by at least one member of the three teacher team assigned to each description. Seventeen, or 74 per cent of the twenty-three boys' descriptions were identified, and eleven or 44 per cent of the twenty-five girls' descriptions were identified.

Ratings were assigned by the teachers from a five point scale after the identities of students had been revealed. The basis for rating was the accuracy of the descriptions as verbal pictures of students behavior as teachers had observed it. The teachers as a group assigned ratings of I and II, or very accurate and accurate, respectively, in 58 per cent of the cases.

Ratings of IV or V, or inaccurate and very inaccurate, respectively, were assigned in 13 per cent of the cases. The mean ratings of each teacher fell between 1.75 and 2.71 indicating that the ratings assigned tended to cluster about the rating of accurate, or II.

#### Conclusions

From the data obtained in the study, it seems reasonable to conclude that:

1. Secondary school students' responses to the Incomplete Sentences Blank tend to reveal projected student needs, attitudes, aspirations, and adjustment difficulties.
2. The interpretations of the completed Incomplete Sentences Blanks, made without the knowledge of students' identities, can be confirmed by qualified persons.
3. The examiner's interpretations of the students' completed Incomplete Sentences Blanks, written as verbal descriptions of the behavior of unidentified students, can be verified as accurate behavior descriptions of the students in a significant number of cases by teachers who have observed the students in the school environment.

Microfilm copy of complete manuscript of 272 pages, \$3.40. Enlargements 6" x 8", 10¢ per page.

#### PRIVATE TRADE SCHOOLS OPERATING IN MISSOURI, 1944 THROUGH 1951

(Publication No. 3830)

Herman Leon Bibb, Ed.D.  
University of Missouri, 1952

#### Purpose

To survey the private trade schools of Missouri approved for veteran training, for the period of 1944 through 1951.

#### Method of Research

Data were procured chiefly from records on file in the office of the Veterans' and Adult Section, State Department of Education. Data on the placement and occupational success of private trade school graduates were obtained through information blanks sent to a sampling of graduates and their employers.

#### Summary and Conclusions

1. After passage of Public Law 346, known as the G.I. Bill, in 1944, private trade schools began to mushroom in Missouri. Congressional actions, until July 1950, were such as to liberalize the legislation and bring veterans into the schools. Meanwhile, state legislation to regulate these schools was lacking. With the passage of Public Law 610, more severe restrictions and curtailments of profit schools became effective.

2. There have been many shortcomings of the private trade schools in Missouri, some stemming from the profit motive and others from the sudden expansion of new and old schools to meet the vast potentialities of the veteran training program.

3. From the time Public Law 346 was passed in 1944, through 1946, the procedure for approval and disapproval of trade schools was confusing and inadequate. With the gradual development and application of standards for approval, the qualifications of private trade schools improved.

4. Abuses by private trade schools in the training of veterans under provisions of the G.I. Bill were lessened under the limited supervision of the Veterans' and Adult Education Section of the State Department of Education.

5. The number of students enrolled in private trade schools was decreasing at the time of the study, due to a lack of veterans for trainees. For the same reason the number of private trade schools was decreasing.

6. Trade training provided in Missouri by private trade schools was costly to individuals and taxpayers.

7. It is likely that many World War II veterans enrolled in trade training courses approved for large amounts of instructional supplies, and having received the supplies, no longer attended the schools.

8. Private trade schools in Missouri have not been too conscious of, nor have they always had consideration for, the supply and demand for trained workers in some of the trades.

9. It was reported that 80 per cent of the students reached in the sample, upon completion of their courses, were employed in the trade for which they were trained. The reasons why many graduates failed to respond are not known. It is probable that these persons were not employed in the trade for which they were trained and hence declined to respond.

10. Occupational success of graduates of private trade schools in the trade for which they were trained, as reported by employers, compared favorably with other employees who had been in similar trades for approximately the same length of time.

#### Recommendations

1. The State Department of Education should make known the facts reported in this study.

2. Legislation should be enacted in Missouri that would regulate and control the operation of private trade schools just as public trade schools are regulated and controlled.

3. If private trade schools are really interested in their graduates' obtaining placement in the trades for which they are trained they should maintain more effective placement records and guidance service, give more consideration to labor supply and demand, and use more adequate bases for the acceptance of students.

4. There should be more uniformity with respect to cost and duration of like trade courses taught by different private trade schools.

5. The minimum educational requirements of private trade school teachers should be equal to those of public trade school teachers.

Microfilm copy of complete manuscript of 223 pages, \$2.79. Enlargements 6" x 8", 10¢ per page.



THE ORGANIZATION OF A  
PUBLIC COMMUNITY COLLEGE PROGRAM  
IN RELATION TO POSTSECONDARY  
EDUCATIONAL INTERESTS AND NEEDS  
IN AN INDUSTRIAL COMMUNITY

(Publication No. 3717)

Myrtle Foster Black, Ph.D.  
University of Michigan, 1952

The purpose of this study is to supply the fullest possible answers to the question: "In what directions should the junior college in Flint, Michigan, move in order to serve most adequately the postsecondary educational interests and needs in this industrial community?"

From the literature, a field study, and four cooperative community surveys, an effort was made to secure data to answer five subsidiary research questions; namely, (1) What are national trends in postsecondary education and to what extent are they reflected in Michigan and in Flint? (2) What are emerging patterns in postsecondary education and what is their significance for Flint? (3) What postsecondary educational opportunities are now offered in Flint? (4) To what extent do these resources meet the postsecondary needs and interests of the community? And, in order to answer this question, (5) What are the postsecondary educational interests and needs in Flint — of high school seniors, of junior college students, of adults on both the credit and non-credit level, of local business and industry, and of the community? Finally, then, in the light of these findings, what is the most promising pattern for the local junior college in Flint? In what directions should it move in order to serve most adequately the postsecondary educational interests and needs of the community?

This problem is timely and significant because postsecondary education in America is at present in a state of flux. Its purposes, objectives, and organizational patterns are being reinterpreted in the light of emerging social, economic, and individual needs. Flint, Michigan, is one of the communities in which this problem is of particular concern. Not only is it a relatively young and growing industrial city, but it has new and unusual financial resources available to work out its postsecondary education problem on a challenging, perhaps a demonstration, basis.

The findings of this study indicate that the most promising pattern for postsecondary education for Flint is the community college. The local junior college should, therefore, plan and progress in its philosophy and organization in the direction of the more complete development and implementation of the community college concept. This involves, among other things, greater community orientation, the further study and identification of community needs, and the provision of additional courses and curriculums to meet the needs of increasing numbers of young people and adults.

Considerable data was secured in this study pointing up the growth and development of adult education and its significance, particularly for the

community college. In moving toward the community college concept, Flint Junior College will have to give the college-parallel, terminal, and adult education phases of its program coordinate status and attention. It will have to experiment with new patterns of organization and services and will have to move increasingly into functional and working relationships with the community which it serves.

It is hoped that the findings of this study may have value for other industrial communities with a similar problem.

Microfilm copy of complete manuscript of 219 pages, \$2.74. Enlargements 6" x 8", 10¢ per page.

MEASURES OF COST  
OF POST WAR SCHOOL BUILDINGS

(Publication No. 3610)

Charles Harold Connolly, Ed.D.  
New York University, 1952

The study aims to determine the percentage distribution of school building costs devoted to the four major contracts; to determine the cost per cubic foot, per square foot, per pupil station and per pupil; to determine the degree to which educational facilities or the use of cheaper materials effect costs; to determine the cost of site development related to the cost of the general construction contract and the total contract; to determine what building standards are found in post-war school buildings and to indicate desirable trends.

The problem of school building costs assumes great importance when one considers that it is estimated that total school enrollment in 1960 will total 37,138,000 compared to 29,828,000 in 1951. This will create tremendous plant problems for school administrators.

The study consisted of an analysis of forty-seven complete buildings on which construction began in New York State between January 1, 1948, and July 1, 1949. The buildings varied from one containing only one classroom to one with fifty-five classrooms. Thirty were elementary buildings, six contained kindergarten through grade twelve, five were junior-senior high schools and one was a senior high school.

It was found that the seven low quality construction buildings cost only 76.5% as much as permanent buildings on a per cubic foot basis and 77.9% as much on a square foot basis. These poorer buildings had only 82.1% as much square footage per pupil station as the permanent buildings.

It was found that the average percentage of the total cost of a school building devoted to general construction increased from the 1930-37 period compared to the 1948-49 period from 75.7% to 77.58%. The average percentage devoted to heating and ventilating decreased from 13.1% to 10.25%. For the plumbing contract the percentage increased from 5.6% to 5.92%; and for the electrical work from 5.6% to 6.25%. In studying site development costs it was

found that the average percent of the total contract spent for site development was only 2.1%. In 47.3% of the cases reported no site development took place.

An analysis of the cost of eighty-eight school buildings built between 1908 and 1915 showed that the average cost was 12.23 cents per cubic foot. All of the eighty-eight buildings in this analysis were built in villages or in third class cities.

In 1931 the average cost of all schools built in New York State was 29 cents per cubic foot. By 1936 this had risen to 31.5 cents per cubic foot and in 1940 it had reached 36.8 cents per cubic foot.

This study indicates that in 1949 the average cost of school buildings being erected at that time, exclusive of low quality construction of temporary buildings, was 93.8 cents per cubic foot.

It has been shown that costs per cubic foot are six or seven times higher than was the case forty years ago. A school building today must have three or four times as much cubage to meet the needs of an identical community a half century ago.

The findings of this study indicate that considerable research must be carried on, preferably on a state wide basis, in the field of school building costs. It is further indicated that much study must be given to the entire problem of financing school building programs. Such areas as reassessment of real property, changes in constitutional debt limitations, state loans to local districts and more state aid for building construction need further research.

Microfilm copy of complete manuscript of 116 pages, \$1.45. Enlargements 6" x 8", 10¢ per page.

#### AN ANALYSIS OF AN ASPECT OF COUNSELOR STYLE BY TOPICAL DISCUSSION UNITS

(Publication No. 3834)

Wilbert J. Dipboye, Ed.D.  
University of Missouri, 1952

#### Purpose

It was the purpose of this study to investigate the sources of variation in some selected features or attributes of counselor style. More specifically the purpose of this study was to answer the following questions:

1. Do counselors vary their styles, or patterns of techniques, from one topical unit of discussion to another?
2. Do counselors tend to differ with each other in their patterns of techniques within one topical unit of discussion?
3. What factors contribute to the variation in style? Is it the counselor, or is it the problems of the clients as indicated by the topical units of discussion?

#### Method of Research

In order to answer the above questions fifty-one verbatim typescript interviews comprising seventeen

complete cases were analysed. Six topical units of discussion were analysed according to nine counselor response categories. In addition to this, two larger units were analysed according to the same counselor response categories.

#### Summary

With regard to information obtained from the analysis of the data, the following points may be listed:

1. Four counselors showed a tendency toward differential styles among the units. Two counselors had a significant similarity in style among the units.
2. In the larger units all of the counselors showed a tendency toward a differential style between these two units.
3. There was a general tendency by the counselors to vary their styles according to the topical units of discussion.
4. There was a tendency for the material to break into larger units. These larger units have been called affective and non-affective units. These two larger units may constitute a simple unit structure by which counselor style may be differentiated.
5. There was a general tendency by the counselors to use similar patterns of techniques in the units.
6. In the larger units there was a significant similarity among the counselors in their use of the counselor categories.

#### Conclusions

1. It was concluded that counselors tend to vary their styles from one topical unit of discussion to another, but that there are individual variations in this tendency.
2. It was concluded that there was a general tendency for the counselors used in the study to use similar styles in each unit, but that there are individual variations in this tendency.
3. It was concluded that the primary source of variation in counselor style was the topical unit of discussion.
4. It was concluded that the two larger units (affective — non-affective) constituted a simpler unit structure than the original units as a basis for the investigation of counselor style.

Microfilm copy of complete manuscript of 119 pages, \$1.49. Enlargements 6" x 8", 10¢ per page.

#### CERTAIN FACTORS RELATED TO TEACHER EDUCATION IN THE DEGREE-GRANTING INSTITUTIONS OF MISSOURI

(Publication No. 3835)

Leland Harry Erickson, Ed.D.  
University of Missouri, 1952

#### Purpose

To describe certain factors related to teacher education in the degree-granting institutions of Missouri with emphasis upon the following specific



factors; (1) General information regarding the academic preparation of certain staff members and the facilities for the education of teachers; (2) student personnel services that relate to teacher education; (3) professional laboratory experiences; and (4) opinions of elementary and secondary school principals regarding the competency of newly trained teachers.

#### Method of Research

Information concerning practices, policies, and conditions prevailing in the degree-granting institutions was procured by information blank returns from twenty-nine institutions. Information blank returns were received from 139 elementary and 117 secondary school principals of Missouri regarding the competency of newly trained teachers.

#### Summary

1. Approximately 62.85 per cent of the staff members in education departments hold master's degrees, 32.64 per cent hold doctor's degrees and 4.51 per cent hold bachelor's degrees.
2. The majority of institutions have provisions for initial selective admission, but the process of selection is so nominal that practically all students who apply are admitted in most institutions.
3. Provisions are made by a large majority of the institutions for continuous appraisal and progressive retention of prospective teachers, with a minimum standard of average scholastic achievement most frequently required for retention.
4. It is not the practice for institutions to systematically provide opportunities for graduates who have been out of school several years to appraise the teacher education programs which they experienced.
5. There is a wide variation in the type and number of professional laboratory experiences provided prospective teachers, with student teaching being the only laboratory experience provided by each participating institution.
6. Professional laboratory experiences are provided in a large majority of the institutions only during the junior and senior years.
7. In many institutions there appears to be little integration of laboratory experiences with other parts of the college program.
8. Except in the state colleges, the proportion of prospective teachers who participate in elementary or secondary school extra-class activities is relatively low.
9. In a large majority of institutions only a small proportion of the prospective teachers participate in community groups and agencies.
10. There is considerable variation among the participating institutions with regard to the length of time prospective teachers spend in student teaching.
11. It cannot be inferred that student teaching is a part of the pre-service training for all Missouri teachers for reason of the fact that some institutions have granted, or are now granting, student teaching credit for teaching done on a regular teaching

position for which the student receives or has received compensation.

12. Judging from the responses of 256 elementary and secondary school principals, the typical beginning teacher has had adequate, or reasonably adequate, pre-service preparation. The majority of principals recognize that inexperienced teachers may have minor deficiencies in certain areas; however, with a reasonable amount of supervision and in-service training, the typical beginning teacher works effectively in such areas.

#### Suggestions

1. A program of self-appraisal should be inaugurated within each institution to determine the effectiveness of the over-all teacher preparation program in providing well-qualified teachers.
2. Programs of teacher education should be subject to constant review and revision by recognized accrediting agencies for the purpose of assuring a gradual upgrowth of the training facilities in which teachers are trained.
3. Persons directly responsible for student teaching should re-examine student teaching programs to ascertain if legal requirements are being met, and to determine if the programs are set up to be of maximum professional value in the total pre-service training program.
4. The student teaching program should be broadened to include more activities and experiences which are similar to those found on a regular teaching position.
5. Institutions should endeavor to bring a greater amount of integration of laboratory experiences with other parts of the teacher education program.
6. Each institution should systematically provide methods for determining the strengths and weaknesses of its graduates in order to better appraise the strengths and weaknesses of its own teacher education program.
7. Secondary school principals, counselors and staff members should assume responsibility with college counselors and college personnel in recruiting suitable students to enter a professional pre-service training program.

Microfilm copy of complete manuscript of 189 pages, \$2.36. Enlargements 6" x 8", 10¢ per page.

#### RELATION OF PHYSICAL, MENTAL, AND CLINICAL CHARACTERISTICS TO THE BIOLOGICAL PROFILES OF SEEMINGLY SATISFACTORILY ADJUSTED ADOLESCENTS

(Publication No. 3747)

Betty Jane Ganzhorn, Ph.D.  
University of Michigan, 1952

This study investigated sixty adolescents who would be classified as "average" or "normal" on the basis of an analysis of their school records. These

adolescents were white and ranged in age from fifteen to eighteen years. Their high school grade averages ranged from C to B+. This group had moved regularly from the first grade to high school without either double promotions or grade retentions. They had not required disciplinary action or special attention from any of the various school services. Their school attendance was regular and their citizenship was good. Their I.Q.'s ranged from 90 to 112 on the California Mental Maturity Test. These adolescents had received satisfactory ratings on an audiometer screening test. They either possessed good visual acuity as determined by the Massachusetts Vision Test or had had appropriate visual corrections. Their medical records indicate that they were physically sound when they entered high school.

The problem inherent in this pilot investigation was a partial evaluation of the biological and psychological characteristics which make possible seemingly satisfactory adjustment. For this purpose, a set of counseling diagnostics was originated which incorporated biological and psychological dimensions of individuality. These diagnostics were tailored to fit the limitations of a school setting, lack of additional personnel, and financing. The biological diagnostics included measurements of height, weight, lengths of right and left arms, legs, and trunk, chest expansion, hip measurement, vital capacity, blood pressure, presence or absence of dermatographia and paradoxical pupillary reflex, inspections of skin, hair, and fingernails, interview questions pertaining to diet, food preference, and amount of sleep per night, inventory of the knee-jerk reflex and its reinforcement, judgments of posture and coordination, vision, and hearing. The psychological diagnostics included interview questions concerning school activities, employment, hobbies, characteristics of gregariousness, preference for physically active or sedentary activities, future career plans, administration of the Wechsler-Bellevue Intelligence Scale, and the writer's subjective impressions of personality during the experimental procedure.

When these diagnostics were employed and the data charted in profile form, it was found that the biological and psychological characteristics of the experimental group formed concomitant patterns that were internally consistent. There was a conspicuous absence of biological and psychological pathology. While this study did not establish cause and effect relationships, it strongly suggests that biological soundness supports and accompanies psychological soundness. In other words, individuals who are satisfactorily adjusted will also be biologically sound. When the data were mathematically treated, they fell within narrow ranges. This suggests that satisfactory adjustment is predicated upon biological and psychological patterns that are concomitant, internally consistent, and fall within relatively narrow boundaries. Should these ranges be established by future investigations which would carry this study to a point of statistical significance, the presentation of a formula for satisfactory

adjustment with a coding system would enable the counselor to predict student patterns of adjustment and to institute an effective combination of medical, educational, and psychological therapy.

Microfilm copy of complete manuscript of 169 pages, \$2.11. Enlargements 6" x 8", 10¢ per page.

#### RELATIONSHIP BETWEEN PHYSICAL SKILLS AND GROWTH IN ELEMENTARY SCHOOL CHILDREN

(Publication No. 3754)

Louis Anthony Govatos, Ph.D.  
University of Michigan, 1952

This investigation was concerned primarily with problems of relationship between measures of growth and performances in physical skills. The growth measures selected included height, weight, grip, dental, carpal, reading and mental aspects which were described in age units. The physical skills included the jump and reach, standing broad jump, soccer kick for distance, twenty-five yard dash, over and underhand ball throw for distance, and the over and underhand ball throw for accuracy.

Forty-five girls and fifty-six boys, between the ages of six and eleven years, were included in this study. These children were enrolled in the University Elementary School at the University of Michigan during 1951-1952.

This study was part of a longitudinal multi-discipline investigation centered in the Child Development Laboratories of the University Elementary School of the University of Michigan. By adding cross-sectional measures of physical skills it becomes possible to interpret them from a more elaborate description of total growth.

The results showed progression in mean performances for both boys and girls at each higher age level. There were significant sex differences in some of the mean motor performances and also in the mean growth measures by age levels.

In the sample studied the boys showed superiority in the events involving kicking, throwing and broad jumping, while the girls performed equally as well on the twenty-five yard dash.

High and positive correlations between chronological age and each of the various physical skills and growth aspects were obtained for the boys and girls in this study. For the boys, dental age correlated higher than any other growth measure with chronological age. Carpal age correlated highest with chronological age for the girls measured. Weight age correlated least with chronological age for these boys and girls.

When chronological age was held constant for the boys the relationships between height, weight or grip age with the soccer kick, over and underhand ball throw for distance, and the overhand ball throw for accuracy were higher than any of the other growth measures used. Grip, dental and carpal age were



significantly related to some of the physical skills for the girls in this sample. The partial correlations between organismic age and the physical skills ranged from -.151 on the soccer kick to .399 for the underhand ball throw for distance for the boys, and from -.097 for the underhand ball throw for distance to .418 on the soccer kick for the girls.

The mean partial correlation for grip age and the physical skills was found to be significantly higher than any other growth measure for the boys at the five percent level. For the girls, the mean partial correlations for dental, grip and carpal age were found to be significantly higher with the physical skills in general than any other growth measure used.

It was concluded that various aspects of physical growth were more related to performances in gross motor skills than were mental growth measures.

Microfilm copy of complete manuscript of 136 pages, \$1.70. Enlargements 6" x 8", 10¢ per page.

#### THE CONTRIBUTION OF RICHARD ELWOOD DODGE TO EDUCATIONAL GEOGRAPHY

(Publication No. 3888)

Paul Francis Griffin, Ph.D.  
Columbia University, 1952

This study is an analysis of Richard Elwood Dodge's contribution to educational geography. Dodge was the first teacher of geography not only at Teachers College, Columbia University, but in any teacher-training institution in the United States. He was a pioneer in championing the cause of human geography; at the same time, he has earned the position as one of the nation's outstanding educational geographers.

His most substantial contributions to human and to educational geography were made during the twenty-one fruitful years he served on the Teachers College faculty. In a sense, early American educational geography was almost synonymous with the program Dodge initiated and developed at this institution.

Despite the dynamic role Dodge played in fashioning the shape of American geography teaching methodology, no one has attempted systematically to identify and to categorize the nature of his contributions to the field. With the increasingly crucial part geography must play in furthering international understanding, it is logical to analyze outstanding teaching methodologies of this subject. Dodge's work, in this respect, provides an excellent starting point.

From the data presented in the study, Dodge's contributions tend to fall into five categories:

1. to geography as a science;
2. to science in general;
3. to education in geography;
4. to education in general;
5. to geography as a profession.

Scientific geographer that he was, he early recognized the duality of its subject matter, and sensed that man and his affairs constituted the dynamic factors in geography, whereas the natural environment constituted the passive factors.

To geography as a science in general, he was the first to point out the possibility of applying the methods of stratigraphy to the study of historical anthropology. He was a pioneer in thinking of the phenomenon of sequent occupance in geography and its application to history.

Dodge's maximum contribution lies specifically in the teaching of geography. He was one of the first, if not the first, to insist that the major role of geography teachers is to explain causal relationships. He developed the concept of increasing circles of relationships and enriched Pestalozzi's concept of home geography, transplanting it into American soil for further growth.

Concerning Dodge's contribution to education in general, the study indicates that his educational activities went far beyond geographical boundaries. In his process of humanizing geography he did much to lay the foundation for modern integration of geography and other social sciences. He was a vital force in shaping the training of teachers for positions in elementary and secondary schools. He did much to systematize teacher placement — a policy which has spread from Teachers College to most colleges and universities in the United States.

In the development of geography, Dodge argued that the advancement of the profession must rest at least in part upon the progress of geography as a teaching field. To promote this idea he founded and was the first editor of the Journal of School Geography. This journal and its offspring, the Journal of Geography, have been most influential in the profession.

Since Dodge and a number of his contemporaries are still available for interview, the investigation, fortunately, has been based in part upon prime-materials and a living document. Dodge's family background and education are treated in the initial part of the study. Further genealogical data is provided in the first appendix. His early professional growth and experiences, up to the Teachers College appointment, take up another section. His work at Teachers College and the development of the geography program at this institution occupy a central part in the inquiry. In a final portion, an exhaustive bibliography of all of his writings is given.

Microfilm copy of complete manuscript of 261 pages, \$3.26. Enlargements 6" x 8", 10¢ per page.

**A STUDY OF THE TRENDS  
IN THE CERTIFICATION OF  
SECONDARY-SCHOOL TEACHERS OF ART  
AND IN THE OBJECTIVES OF SUCH TEACHING**

(Publication No. 3760)

Cleobelle Harrison, Ed.D.  
University of Michigan, 1952

**Problems**

To determine the trends in the certification of secondary-school teachers of art and in the objectives of such teaching;

To summarize the certification requirements for such teachers in the forty-eight states and the District of Columbia, and to supplement these requirements with additional information secured from the various states;

To determine what a jury of specialists in the teaching of art consider should be the requirements for certification to teach art in secondary-schools, and the acceptable objectives of art instruction at the secondary level;

To compare the existing requirements with those approved by this jury.

**The Method**

The trends in the certification of high-school teachers of art, and in the objectives of such teaching were determined from an analysis of the pertinent literature of the past forty years.

A summary was made of the requirements for all certificates issued for the teaching of art in the secondary-schools of the Union, as included in the report of the Federal Security Agency, Certification Requirements for School Personnel. Supplementary facts were obtained from the certification bulletins of the various state departments of education and from the certifying officers.

The opinions of a jury of specialists in the teaching of art with respect to both the issues revealed in the data and to the objectives for the teaching of art in high-schools, were obtained with a questionnaire.

**Conclusions**

1. Specialists in the teaching of art are exerting a salutary influence toward securing a higher selection of art teachers for secondary-schools.

2. The trend away from issuing special certificates for teaching art in secondary-schools, reflects the influence of leading authorities in the field.

3. The need is indicated for a redefining and re-evaluation of courses in art, for the sake of standardizing course names and contents.

4. The art teacher cannot secure so broad a background in his specialized field and still secure as broad a general training outside the field of art as is probably desirable.

5. The amount of training deemed necessary for teachers of art is less extensive than is that of teachers of other high-school subjects.

6. Either the certification requirements of the various states were not formulated recently enough to reflect the current trends in art education, or

experts in the field had not been consulted by the certification boards, with respect to what the requirements for prospective high-school teachers of art should be.

7. The specialists indicated their belief that, with respect to almost half the requirements, the ultimate goals of preparation had already been attained.

8. The reaction of a large proportion of the experts indicates astonishingly little faith in the superior values of courses in special methods of teaching art.

9. The need for further careful and critical evaluation of the objectives of this important field of education seems evident.

Microfilm copy of complete manuscript of 192 pages, \$2.40. Enlargements 6" x 8", 10¢ per page.

**RELATION OF PARENTAL AUTHORITARIANISM  
TO THE ADJUSTMENT OF  
HOME-RESIDENT COLLEGE STUDENTS**

(Publication No. 3762)

Arthur Louis Henze, Ph.D.  
University of Michigan, 1952

This study sought to gather information about certain types of action taking place between college students and their parents. It also sought to investigate how these student-parent relationships were associated with student adjustment. The study is based on data reported voluntarily in November, 1950, by 250 students at the University of Toledo.

Student adjustment was measured by responses to the Ross L. Mooney Problem Check List. Total scores on the Problem Check List were divided into quartiles, and students whose scores were in the upper quartile were designated poorly adjusted, those in the lower quartile, well adjusted, and those in the two mid-quartiles, moderately adjusted. All three groups were made up of presumably "normal" college students.

Information about student-parent relationship was obtained by a questionnaire, devised by the writer after two pilot studies. By checking the appropriate multiple choice response the student indicated his judgment concerning the number of times his parents acted in such a manner as to be classified as "Indifferent," "Permissive," "Suggestive," or "Authoritarian." He also indicated his reaction to his parents as "In mutual agreement," "Obey under protest," "Disobey," or "Neutral."

Using the chi-square method, the writer made detailed statistical analyses of the relationships between student adjustment and the type of parent and also the type of student reaction to parent. He also analyzed demographic data relative to student adjustment on the one hand, and to parental authoritarianism, on the other.

The most significant conclusions are as follows:  
Poor adjustment on the part of students is most



clearly associated with "authoritarian" parents. Chance factors are negligible in the statistical analysis of this point. However, the relationship between parental authoritarianism and poor student adjustment is not absolute; that is, there are some well adjusted students who report "authoritarian" parents.

Good adjustment of students is associated most clearly with parents who are classified as "interested but not authoritarian;" that is, those who were at times "permissive" and at other times "suggestive" but who were rarely, if at all, "indifferent," or "authoritarian."

Well adjusted students reported that they were most often "in mutual agreement" with their parents.

Poorly adjusted students are to be found most often among those who reported that they were "in friction" with their parents; that is, they either "disobeyed" or "obeyed under protest."

Students were most often "in friction" with parents classified as "authoritarian."

Microfilm copy of complete manuscript of 205 pages, \$2.56. Enlargements 6" x 8", 10¢ per page.

RELATIONSHIP BETWEEN VARIOUS FACTORS  
AND TYPES AND FREQUENCIES OF  
PROBLEMS BROUGHT TO  
VOCATIONAL HOMEMAKING TEACHERS  
IN SEVENTY-SEVEN MICHIGAN HIGH SCHOOLS

(Publication No. 3763)

Eunice Elizabeth Herald, Ph.D.  
University of Michigan, 1952

The purpose of this study was to determine the relationship between various factors and the types and frequencies of problems which were brought to the eighty-six vocational homemaking teachers in seventy-seven high schools in Michigan in the fall of 1950.

Teachers were asked to record the problems which their pupils voluntarily brought to them for discussion. To ascertain whether there were any relation of such problems to certain factors which normally might be assumed to affect them, information about the sizes and types of communities and schools, availability of special guidance personnel, background information about teachers and pupils, and the like, was secured.

All told, 1,323 problems were collected and then classified into seven categories, as follows: Social, Personal, Health, Choice of School Subjects, Choice of College, Choice of Vocation, and Miscellaneous. Problem illustrations are given for each of the subdivisions of the seven categories. Finally the problems were studied in relation to the following factors: community size and type; school size; the special guidance personnel available; the teachers' experience and special guidance training; the students' ages, grade placement, employment,

extracurricular activities, number of siblings, fathers' occupations, and home conditions.

The statistical techniques included Pearson correlations and the measurement of significance of differences of means by a modified formula for the Fisher  $t$ .

Two general conclusions can be drawn from this study:

1. That there was a significant relationship between the types and frequencies of the problems and each of the following factors: the size and type of community; the size of school and the number of guidance personnel available; the teachers' guidance training; the students' grade placement, work experience, number of siblings, and status of the home as indicated by the fathers' occupations.

2. That there was no significant relationship between the types and frequencies of the problems and each of the following factors: teachers' experience; ages of students; and extracurricular activities.

Microfilm copy of complete manuscript of 180 pages, \$2.25. Enlargements 6" x 8", 10¢ per page.

DESIGN AND EVALUATION OF AN IN-SERVICE  
TRAINING PROGRAM FOR TEACHERS  
IN CHILD GROWTH AND DEVELOPMENT

(Publication No. 3766)

Walter Sulo Holmlund, Ph.D.  
University of Michigan, 1952

The purpose of this study is to show the design and to measure the effectiveness of the Flint (Michigan) in-service training program for teachers in child growth and development which is now in its sixth year. The working hypothesis assumes that if teachers can be helped to detect and properly evaluate childhood behavior as it occurs daily in their classrooms, and in some cases to treat these behaviors, that better learning situations will develop and perhaps many serious behavior problems can be prevented.

The year chosen for this inquiry was 1949-50. Sixty-nine teachers, representing all teaching levels, voluntarily enrolled in the course which extended over a period of thirty-two weeks. A "before and after" inventory of ability to diagnose was administered to this group as well as to a control group of forty-two teachers selected from the same buildings. Analysis of scores achieved were examined on various bases and significance of differences between the two groups was determined.

Another procedure involved having building principals make an evaluation of the ability of the two groups of teachers described to diagnose and treat problem behavior, their ability to get along with parents, and their ability to maintain a healthful emotional climate in their classrooms. The principals did this without knowing which teachers had taken the course.

Still another measure of the effectiveness of the in-service training course was obtained by having ninety-eight teachers enrolled in the 1951-52 class indicate their personal reactions to the program.

The results of these evaluations revealed that the teachers in the experimental group achieved higher scores on the inventory given at the end of the year than did those in the control group, indicating that the year's training in child growth and development had improved their ability to diagnose and suggest remedial measures for behavior problems. Analysis by age groups showed that the teachers under forty years of age achieved higher total mean scores which indicates that this group responded to a greater degree to instruction and guidance in child development than those in the other age groups.

The principals' ratings were based on first-hand observations of the teachers in the daily teaching situation. When the ratings on all points were considered there was no question about superiority as judged by the building principals; they had chosen the experimental group by a wide margin.

The verbatim comments by the teachers indicated that the course had not only been helpful to them in gaining a clearer conception of child growth and behavior but it had given them, through the case study technique, an opportunity to put into practice remedial measures that were suggested by the various lecturers. In addition, their comments indicated that the new insights gained during the year had helped to improve their own educational philosophy.

The general conclusion of this study is that the Flint in-service training program in child growth and development, cooperatively planned, staffed with competent instructors, and taught under informal and relaxed conditions, produced highly beneficial changes in the teachers' understanding of child behavior and in their ability to deal with various types of behavior in a manner that will not only be beneficial to the child but satisfying to herself as well.

Microfilm copy of complete manuscript of 125 pages, \$1.56. Enlargements 6" x 8", 10¢ per page.

#### A PROGRAM OF PHYSICAL EDUCATION FOR INDIA

(Publication No. 3767)

Arthur Wesley Howard, Ph.D.  
University of Michigan, 1952

The welfare of its people is a matter of great concern to the leaders of free India. The two problems of raising the standard of health, and reorganizing and expanding education are vital ones in India's program for betterment.

The problem of health must be attacked upon many fronts, but the contribution of physical education activities to abundant health should not be overlooked in the face of the enormous problems of malnutrition and disease. Likewise, physical education

should be a part of an all-round education designed to prepare students for life in a democracy.

The purpose of the study is to present suggestions to help enable physical education to contribute more effectively to the health of the people, and to find its rightful place in the reorganization of education.

The study examines present practice in India in the field of physical education, though its development is not ignored. It presents the opinions of competent men, as expressed in personal writings and committee reports, as to the problems facing the subject, and their suggestions for their solution. The proposals of the Bhore and Sargent committees, as well as the resolutions of the All-India Physical Education Conference, of 1946, and the findings of the committee for physical education appointed by the Government of India, in 1948, are given special attention.

The work being done by the government and All-India agencies to promote physical education in India is presented. This includes some consideration of provincial governmental organization, the work of the National Association for Physical Education, Health, and Recreation, India, and that of the Olympic Association.

The problems presented seem to center about the attainment of status for physical education, of unity among its leaders, and its promotion by the government. The suggestions presented are of a general, but fundamental, nature intended to produce such status, unity, and promotion. They are designed only as a guide. Trained physical education leaders are expected to be placed in charge of the national program to develop the details as experience dictates.

Microfilm copy of complete manuscript of 174 pages, \$2.18. Enlargements 6" x 8", 10¢ per page.

#### STATUS AND TRENDS IN GRADUATE INDUSTRIAL TEACHER EDUCATION IN THE UNITED STATES

(Publication No. 3841)

Roderick George Kohler, Ed.D.  
University of Missouri, 1952

##### Purpose

To ascertain the current status and trends in graduate programs in industrial teacher education in the United States.

##### Method of Approach

Data were obtained by information blanks sent to chairmen of sixty-six departments of industrial education which offered graduate work with a major in that field.

##### Summary and Conclusions

Graduate work in industrial teacher education was given only in industrial arts at twenty-six institutions, only in vocational-industrial education at four, in a program combining industrial arts and



vocational-industrial education at nineteen, and in separate programs in the two areas at seventeen institutions. Approximately one third of the institutions included in this study began offering graduate work in this field since 1945, and 57.7 percent of the institutions offering graduate work in industrial education limited to industrial arts, established their graduate programs since that date.

More institutions granting the doctoral degree with a major in industrial education, are making the degree available by attendance during the summer sessions.

There is little uniformity regarding the minimum residence requirements for graduate degrees with a major in industrial education.

Many institutions allow undergraduate credit for trade experience in meeting entrance requirements for students majoring in vocational-industrial education.

There is little consistency regarding the entrance requirements for graduate study in industrial teacher education.

Less than one tenth of the institutions would not accept graduate credit from another approved institution toward the master's degree.

The number of institutions which will accept extension work offered by resident staff members toward the master's degree is increasing, and the amount accepted is also greater.

A majority of the institutions cooperating in this study allowed graduate credit for shop courses to apply toward the master's degree. The amount of credit accepted for this type of graduate work is increasing.

Little uniformity appeared to exist among the institutions regarding the amount of credit which was recommended or required in industrial education for a major, in related areas in education, or in related fields outside of education.

Fewer institutions are now requiring a thesis for the master's degree in industrial education, and more institutions are now accepting additional course work as a substitute for the thesis.

Fifty-two of the fifty-nine responding institutions required a comprehensive examination in industrial education for the master's degree, and only one of the responding institutions indicated a comprehensive examination in industrial education was not required for the doctoral degree.

Of the staff members who were giving graduate instruction in industrial education, 67.4 percent held the master's degree as the highest earned degree; 22.2 percent, the doctorate; 8.8 percent, the bachelor's degree, and 2.1 percent, did not have a degree.

A greater percentage of staff members with lower rank are now teaching graduate courses in industrial teacher education.

There is a wide variation in the graduate course offerings in industrial education at institutions offering work in this field.

Forty-four of the fifty-nine responding institutions indicated some form of financial assistance was available to graduate students in industrial teacher education.

During the year of 1949-50, including the summer session of 1950, 2,514 graduate students were enrolled with a major in industrial arts; 885, in vocational-industrial education; and 775, in a program combining the two areas. During this same period, 1,017 students received graduate degrees in industrial teacher education. The areas of specialization were: industrial arts for 641 students, vocational-industrial education for 189 students, and a program combining the two areas for 187 students. Twenty-eight students received the Doctor of Education degree and eighteen, the Doctor of Philosophy degree.

The number of graduate students majoring in industrial arts is increasing and the number majoring in vocational-industrial education is decreasing.

Microfilm copy of complete manuscript of 198 pages, \$2.48. Enlargements 6" x 8", 10¢ per page.

#### AN ANALYSIS OF THE ACTIVITIES, TRAINING, AND OPINIONS OF COORDINATORS OF COOPERATIVE VOCATIONAL EDUCATION

(Publication No. 3842)

George Emmitt Kohrman, Ed.D.  
University of Missouri, 1952

#### Purpose

To analyze the activities, training, and opinions of coordinators of cooperative part-time vocational education and to ascertain what implications, if any, such activities, training, and opinions might have for the improvement of the professional education of teacher-coordinators.

#### Method of Approach

Data were obtained from information forms returned by 292 coordinators of industrial cooperative programs and 191 coordinators of cooperative programs in business occupations located in forty-two states and the territories of Hawaii and Puerto Rico.

#### Summary and Conclusions

The number of cooperative vocational programs which have been organized during the past ten years has exceeded the supply of qualified and professionally trained coordinators. As a result, some individuals have been certified as coordinators with little or no occupational experience or vocational professional training.

On the average, the coordinators had approximately seven and one-half years of teaching or administrative experience and four years of occupational experience in business or industry prior to employment in the field of cooperative vocational education. Approximately 20 per cent of the coordinators had no more than twelve months of occupational experience of any kind.

Over 59 per cent of the business coordinators and 50 per cent of the industrial group had completed the Master's degree. The average number of

semester hours of college work completed by the former group was 154.4 and by the latter, 160.2 semester hours.

Business education was listed most frequently as the undergraduate major subject and social science as the undergraduate minor subject taken by coordinators of cooperative programs in business occupations. Industrial arts was listed most frequently as the major subject and social science as the minor subject taken on the undergraduate level by coordinators of industrial programs.

Business coordinators had completed, on the average, 13.1 semester hours and the industrial coordinators 19.6 semester hours of vocational professional education courses at the time of the study. Approximately 20 per cent of the former and seven per cent of the latter group indicated that they had not completed any work of this nature.

Over 50 per cent of the respondents employed in the business education field and about 38 per cent of those employed in the training of industrial workers reported no vocational professional course work completed prior to employment.

Two-thirds of the business coordinators and nine-tenths of the industrial group expressed the opinion that certain vocational professional courses should be completed prior to employment. The courses suggested most frequently were: "Problems of the Coordinator," "Occupational Analysis," "Principles of Vocational Education," and "Methods of Teaching Vocational Subjects."

Three-fourths of the coordinators believed that individuals preparing for work in this field should serve an apprenticeship prior to employment on a full-time basis. The average length of the apprenticeship period suggested was slightly less than one semester.

Individuals who are preparing to become coordinators of business cooperative programs need a broad educational background in business or commercial subjects, while the industrial coordinators need a broad educational background in industrial arts subjects.

The duties, responsibilities, and activities of coordinators of cooperative programs in business occupations are similar to the duties, responsibilities, and activities of coordinators of cooperative programs in industrial occupations except in the area of occupational analysis. Moreover, for the most part, business and industrial coordinators hold similar opinions as to the importance of the activities which they perform in the organization and operation of cooperative programs. They likewise hold similar opinions as to the training needed in order to perform the various activities involved in the coordinator's job. In general, both groups believe that teacher-education institutions should provide instruction in the performance of these activities.

Business coordinators and industrial coordinators need essentially the same type of pre-employment and in-service vocational professional education. Both groups need more training in the areas of public speaking, public relations, and guidance.

Industrial coordinators work more closely with organized labor groups and governmental agencies than do business coordinators. Industrial coordinators also place more emphasis on the use of occupational analysis techniques and individual instruction procedures.

Microfilm copy of complete manuscript of 230 pages, \$2.88. Enlargements 6" x 8", 10¢ per page.

# A STUDY OF SELECTED CURRICULUM PRACTICES IN AMERICAN SECONDARY EDUCATION WHICH MAY HAVE SIGNIFICANCE FOR THE TAGHIZ SCHOOL FOR GIRLS IN DAMASCUS, SYRIA

(Publication No. 3702)

Marzia Abdul-Hamid el-Kouatly, Ed.D.  
New York University, 1951

## The Problem and Its Importance

The chief purpose of the study was to select current practices in American secondary education which may have significance for improving the educational program in The Taghiz School for Girls in Damascus, Syria. A further purpose was to develop a plan for adapting and introducing into Syrian secondary education certain practices found to be effective in American secondary schools.

It is believed that this study may render service in a time of changing political, socio-economic and educational concepts by projecting a concrete program of change for education. The investigator also believes that a study of the nature proposed would do much to provide support and help for changes needed in Syrian education.

## The Background of the Problem

The investigator was a teacher for five years in The Taghiz School for Girls. In 1948, she was sponsored by the Ministry of Education to come to the United States for a year of experience in American education. Since February 1949, she has been on a leave of absence for the purpose of studying American practices which may be adapted in the secondary schools in Syria.

## Procedures Used in Collecting Data and Types of Data Collected

1. The first sub-problem was to determine the need for improving the curriculum in The Taghiz School for Girls in Damascus. Literature dealing with social, economic and cultural conditions of Syria was analyzed. Through reading of related literature and through correspondence with people in Syria the current status of education in the country and in The Taghiz School were determined. From the study of needs of American youth, from proposals made at the Arab League conference in August 1951, and from the above findings a descriptive analysis of the needs of Syrian youth were made.



2. The second sub-problem was to study selected curriculum practices in American schools which might be related to the need for improving the curriculum in The Taghiz School for Girls. In the study of selected curriculum practices in American secondary schools, literature on American education was read and analyzed. Twenty schools approved by the sponsoring committee were visited, principal, teachers, and guidance directors were interviewed and some classes were observed in action.

3. The third sub-problem was to determine secondary school curriculum practices which have significance for The Taghiz School. Before drawing conclusions regarding the implications of the practices to The Taghiz School a summary of the findings was made.

4. The fourth sub-problem was to study and describe democratic supervisory practices in American education that may have significance for Syrian secondary education. Supervisory procedures in American education which may be applied in introducing desirable practices were analyzed. Available literature on supervision was read, principals were interviewed and teachers and children were observed. From the findings the investigator described the role of the supervisor in modern education.

5. The fifth sub-problem was to develop a plan for adapting and introducing into The Taghiz School curriculum practices selected from American education for their significance to Syria.

#### Conclusions

The Syrian youth have needs: physical, social, economic, aesthetic and educational, which should be more adequately met. Each youth should be equipped with occupational skill which suits his abilities and interests; each needs to be provided with responsibilities for leadership, to achieve happiness, and to have assistance in understanding his society and community, and in developing appreciation of ethical values. The Taghiz School program should no longer be limited to preparation for college but rather should be concerned with the total personality and growth of the child.

Education in The Taghiz School should stress education for family life, consumer education, citizenship, vocational preparation, creative use of leisure time and the like. The varied needs of the pupils may be met by:

1. A core program commensurate with Syrian culture and philosophy whereby the Taghiz girls learn how to work on projects to improve their homes and community should be developed.

2. The common as well as the varied needs of the pupils may be provided through the application of guidance techniques. Each teacher should assume the role of a counselor.

Creativity and experimentation among both pupils and teachers should be encouraged. Every pupil should be provided with the opportunity to develop her talents: musical, artistic and vocational.

4. Provide for democratic living among pupils, teachers and community. The school, in order to become a dynamic agency in reconstructing the Syrian

society, must be democratized and must be an integral part of the life of the community. The school should be a place where pupils get together to solve important problems.

With this type of modern school program there is need for supervisors who release the creative talents of those with whom they work: pupils, teachers and community people. There is need for supervisors who bridge the gap between themselves and the teachers by meeting them on common ground and providing them with professional leadership and assistance. The supervisor functions through group processes; he encourages leadership; he cooperates with the teachers, pupils and community in solving basic problems.

Microfilm copy of complete manuscript of 237 pages, \$2.96. Enlargements 6" x 8", 10¢ per page.

#### A COMPARATIVE SURVEY OF SAMPLES FROM THE JUNIOR AND SENIOR POPULATION OF THE COLLEGE OF EDUCATION AND THE COLLEGE OF ARTS AND SCIENCES, UNIVERSITY OF MISSOURI, WINTER SEMESTER, 1950-1951

(Publication No. 3846)

Robert T. McKibben, Ed.D.  
University of Missouri, 1951

The purpose of this investigation is to study certain general characteristics of a sample of the junior and senior population of the College of Education, University of Missouri, winter semester, 1950-51. To make these data more meaningful they are compared with similar data gathered from a sample of the junior and senior population of the College of Arts and Sciences of the same university and session. This latter group is used for comparative purposes because of its relatively unselected vocational or professional status. These data were gathered from the responses of these students to an information blank and from their academic records at the University. The study is designed to aid in meeting the need for general information concerning these students who are preparing themselves to be teachers and to test the validity, as far as these students are concerned, of the charge that students in professional training institutions for teachers are inferior in scholarship and in certain other characteristics to students in liberal arts colleges.

The two samples are surveyed and compared on the basis of the following characteristics that may influence success in the professional training of teachers:

#### 1. Student Personnel Background

- (a) age, sex, and school-year classification
- (b) educational experience, including size of elementary and high schools last attended
- (c) high school extra-curricular experience
- (d) work experience

- (e) location of home
- (f) size of family
- (g) educational, financial, and occupational status of family
- 2. Present Situation (at time of survey)
  - (a) scholastic attainment
  - (b) reading and avocational interests and habits
  - (c) part-time work
  - (d) social affiliation
  - (e) activity participation
- 3. Attitudes Concerning the Teaching Profession in Comparison with Certain Other Professions
  - (a) professional and social status of teaching
  - (b) appropriate pay for teachers
  - (c) difficulty of performance of the work in teaching
  - (d) personal requirements for success in teaching
- 4. Purposes for Attending College
  - (a) general purposes for attending college
  - (b) purposes for attending College of Education
  - (c) purposes for attending College of Arts and Sciences
- 5. Future Plans and Expectations
  - (a) type of work into which entrance is anticipated
  - (b) expected permanency of initial type of work
  - (c) type of work anticipated by time of retirement age
  - (d) anticipated yearly starting salary
  - (e) anticipated maximum annual salary during working life

The findings show marked similarity between the two samples in almost all of the characteristics surveyed. The following conclusions are drawn:

1. The majority of the students in the sample chosen from the College of Education is composed of women, the majority of the students in the sample chosen from the College of Arts and Sciences is composed of men. The large majority of the differences existing between the two groups is apparently the result of differences between the sexes rather than differences between the samples.
2. As a group, the students in the sample chosen from the College of Education appear to be very similar to the students in the sample chosen from the College of Arts and Sciences in respect to almost all of the characteristics surveyed in this study.
3. Differences appearing between the two samples, which apparently cannot be entirely attributed to differences between the sexes, are but slight.
4. As a group, the students in one of these samples cannot be said to be either inferior or superior to those in the other in respect to the characteristics surveyed in this study. In so far as these samples are concerned, no support can be given to the charge that students in teacher training institutions are inferior to students in liberal arts colleges.
5. As a group, the students in the Education Sample, who are preparing to enter the teaching

profession, are not inferior to the students in the Arts and Sciences Sample, who are preparing to enter many types of vocations and professions, in respect to the characteristics surveyed in this study.

Microfilm copy of complete manuscript of 273 pages, \$3.41. Enlargements 6" x 8", 10¢ per page.

#### CONDITIONS OF FACULTY SERVICE IN MID-WEST JESUIT COLLEGES AND UNIVERSITIES

(Publication No. 3953)

Jerome John Marchetti, Ph.D.  
University of Minnesota, 1952

The problem of providing conditions of work and an institutional environment conducive to faculty efficiency and productivity has increased in interest and importance during the past two decades as evidenced by periodical articles, learned studies, and research projects. Despite the extent of this body of literature, few studies were found which systematically treat the entire problem. This study was undertaken, therefore, to determine the practices and policies of Mid-West Jesuit institutions of higher learning with respect to conditions of faculty service. All of the nine Jesuit colleges in the north central states were included. The definition of conditions of faculty service was developed through an analysis of previous studies and recommendations in this area. Those factors which had been studied most frequently and which had shown the greatest promise in effecting desirable working conditions were selected as constituting a restrictive, descriptive definition of conditions of faculty service. This definition included rank and promotion, tenure and academic freedom, salaries, insurance and retirement provisions, service load, clerical assistance for faculty members, leaves of absence, provisions for attendance at professional meetings, and faculty welfare services.

The relevant literature was investigated and served in orienting the problem as well as in preparing a twenty-four page check-list and nine supplementary forms covering fifteen pages for tabulating information. Data concerning conditions of faculty service were gathered by means of a personal visitation to the participating institutions where administrative officials were interviewed, pertinent institutional documents were examined, and factual information was assembled.

Although the Jesuits, a Catholic religious order, control and administer these nine institutions located within the geographical confines of the North Central Association of Colleges and Secondary Schools, non-Jesuits constitute approximately 75 per cent of the total full-time, academic faculty. As the institutions become larger, the percentage of Jesuit faculty members becomes smaller. This trend towards an increasing proportion of non-Jesuit faculty members indicates some of the major problems confronting these institutions.



The study of conditions of faculty service in these institutions revealed the following weaknesses: (1) although there was evidence of serious attempts to administer rank and promotional policies, techniques for evaluating promotional factors were quite casual and most often consisted of the general impressions of recommending officers; (2) salaries were low especially when compared with the larger institutions, both state and privately controlled; (3) even though most institutions were moving into sounder practices with respect to insurance and retirement provisions, monetary allowances were still noticeably below currently recommended optimum figures; (4) although there was some evidence of attempts to study the entire service load of faculty members, the technique of teaching-hours was the most commonly employed device for determining work load; (5) provisions for clerical assistance for faculty members were inadequate and there was little evidence of planning or concern on the part of administrators; (6) there were no realistic provisions for leaves of absence for scholarly purposes; and (7) there were only isolated attempts to provide such welfare services as housing, health provisions, loan funds, facilities for cooperative purchasing, and recreational opportunities for non-Jesuit faculty members.

Questions of faculty working conditions are vital issues in these institutions. While there was evidence of planning and progress in some areas during the past five years, there is urgent need for a systematic program of continuous study and improvement of conditions of faculty service, especially as they concern the non-Jesuit staff. With non-Jesuit faculty members constituting three-fourths of their academic staffs, the success of these institutions is vitally associated with the quality and initiative of this group. If these institutions are to make a significant contribution to American higher education, they must give increasing attention to establishing conditions of work and an environment which will attract, hold, and give opportunities for development to non-Jesuit faculty members. It is little less than futile to try to educate and stimulate these faculty members to self-improvement, effective teaching, and productivity when they do not have adequate time, facilities, and professional and economic rewards commensurate with such expectations.

Microfilm copy of complete manuscript of 331 pages, \$4.14. Enlargements 6" x 8", 10¢ per page

#### A STUDY OF READING ABILITY IN ITS RELATION TO THE SRA PRIMARY MENTAL ABILITIES TEST

(Publication No. 3849)

Francis Norwood Marquis, Ed.D.  
University of Missouri, 1952

#### Introduction

The major purpose of this study was to secure information which might permit more effective use

of the SRA Primary Mental Abilities Test (Elementary) in the diagnosis of reading difficulties. The following specific questions were considered:

1. To what extent is each of the measures of the SRA Primary Mental Abilities Test (Elementary) related to measured reading comprehension?
2. Which combination of subtests of the intelligence test provides the highest multiple correlation with measured reading comprehension?
3. How do high and low achievers in reading compare in the significant areas of the intelligence test?
4. How do children whose reading ages are markedly above or below their respective mental ages compare on each of the measures of the intelligence test?

#### Procedure

The SRA Primary Mental Abilities Test (Elementary) and Forms L and M of the Iowa Every-Pupil Test of Silent Reading Comprehension, Part I, were administered to 364 children in grade IV. Measured reading comprehension was determined by the combined scores of the two reading tests.

The data were treated to derive the following:

1. Zero-order coefficients of correlation between measured reading comprehension and each of the measures of the intelligence test.
2. Multiple correlation to ascertain combinations of subtests yielding the highest degree of relationship to measured comprehension.
3. The numbers of students ranking as highest achievers in reading who fall in each quartile on each of the measures of the intelligence test. The same procedure was followed with those ranking as lowest achievers in reading. (Each of these "deviate" groups comprises one-fourth of the total group.)
4. The critical ratio based upon the standard error of the difference between the mean of each of the measures of the intelligence test for the fifty accelerated readers and the mean of each of the measures for the fifty retarded readers to determine the areas in which one group is significantly better than the other group. In addition, the numbers of accelerated readers who fall in each quartile on each of the measures of the intelligence test was determined. The latter procedure was followed with the retarded readers also. The obtained reading age was divided by the obtained mental age. (The fifty with the highest resulting quotient were called "accelerated" readers. The fifty with the lowest resulting quotient were called "retarded" readers.)

#### Conclusions

Within the limitations of this study, and in light of the obtained findings, the following conclusions appear to be valid:

1. A "high" relationship exists between Verbal-meaning (total) and reading ability, and between Verbal-meaning (words) and reading ability. A "substantial" or "marked" relationship exists between reading ability and the total score, Reasoning (word grouping), Verbal-meaning (pictures), and Reasoning (total). A "low" relationship exists between reading ability and Space, Reasoning (figure grouping),

Perception, and Number. The subtest, Verbal-meaning (pictures), a test of word meaning without word recognition, has a higher relationship with reading ability than those subtests which are both non-reading and non-verbal.

2. The measured components of intelligence which contribute primarily to an estimation of reading capacity are Verbal-meaning (words), Reasoning (word grouping), and Verbal-meaning (pictures). The addition of Space, Reasoning (figure grouping), Perception, and Number add little or nothing.

3. As a group, low achievers in reading perform better on the Verbal-meaning (pictures) subtest than on the Verbal-meaning (words) subtest. With the high achievers in reading, a small variation in the performance on these two subtests favors the Verbal-meaning (words) subtest. It would appear, therefore, that use should be made of the Verbal-meaning (pictures) subtest to avoid the effect of reading achievement upon the measurement of capacity.

4. As a group, accelerated readers perform significantly better than the retarded readers in the areas which are dependent upon reading ability, or a knowledge of words, or both. In general, the retarded readers as a group perform significantly better than the accelerated readers in the areas which are both non-reading and non-verbal.

Microfilm copy of complete manuscript of 136 pages, \$1.70. Enlargements 6" x 8", 10¢ per page.

#### THE ORIGIN AND DEVELOPMENT OF SECONDARY SCHOOL ACCREDITATION IN MISSOURI FROM 1888 TO 1920

(Publication No. 3851)

Floyd Laverne Mullinix, Ed.D.  
University of Missouri, 1952

##### Purpose

To trace the origin and development of secondary school accreditation in Missouri from its early beginning to 1920.

##### Method of Research

The historical method of research was used in tracing the origin and development of secondary school accreditation. The major primary sources were records and publications of the University of Missouri, and the annual reports and other publications of the State Department of Education of Missouri.

##### Recapitulation

1. Prior to 1888 the high schools of the State and the University of Missouri represented two separate state systems. The history of the origin and early development of accreditation is the history of an effort to unite these two separate state systems into two closely related and mutually cooperative parts of one system.

2. Accreditation of secondary schools in the United States began to receive attention around 1870.

3. The initiative for secondary school accreditation in Missouri was taken by the Missouri State Teachers Association.

4. A plan of cooperation between the secondary schools and the University of Missouri was adopted by the Missouri State Teachers Association in June 1887. The University of Missouri recommended a substitute plan in 1888. Twenty-three schools were listed by the University in 1890 whose certificate would admit the bearer to the freshman class without examination.

5. This articulation plan was later implemented with inspection by members of the University faculty. These faculty members proved to be unsatisfactory at this task. In 1894 an Examiner of Schools was appointed by the University to devote full time to that job.

6. The standards for approval of secondary schools prior to 1894 concerned only the courses of study. In 1894 the standards for approval, though not immediately enforced, were raised appreciably. Qualifications of teachers and condition of library and laboratory equipment became factors in the approval of a school.

7. In 1903 the State Superintendent of Public Schools was authorized by law to inspect and classify the public high schools of the State into first, second, and third class.

8. There is some evidence to indicate that both the University and the State Superintendent desired to exert the major influence in accrediting the secondary schools of the State.

9. The University and the State Department of Education cooperated in inspecting, classifying, and accrediting the secondary schools of the State between 1911 and 1915.

10. After 1915, for all practical purposes, the State Department of Education inspected and classified all the public high schools of the State.

11. In 1917 the University agreed to visit and accredit the private and parochial secondary schools.

12. The major changes in the conditions for approval of schools that were made between 1903 and 1920 were, for the most part, caused by the rapid growth of the high school population and the desire of school authorities to adapt their courses to the varying needs and interests of this larger group of students.

13. During the period covered by this study, the major emphasis in accrediting secondary schools shifted from curricular to administrative requirements.

14. In the period covered by this study the principle of inspection and accrediting of secondary schools seems to have passed from a period of mere acceptance to that of wholehearted support as a part of the fixed educational policy of the State.

Microfilm copy of complete manuscript of 263 pages, \$3.29. Enlargements 6" x 8", 10¢ per page.



**AN ANALYSIS OF THE COMMUNICATION NEEDS  
OF HIGH SCHOOL SENIORS  
IN A SELECTED SECONDARY SCHOOL**

(Publication No. 3852)

John A. Munski, Ed.D.  
University of Missouri, 1952

**Purpose**

To analyze the English communication needs in the areas of writing, speaking, reading, and listening of high school seniors in a selected secondary school.

**Method of Research:**

Data were secured from a check list which the 156 members of the 1951 graduating class of the senior high school in Marshalltown, Iowa, marked to indicate the frequency of use, the effectiveness of use, and the sources of learning of writing, speaking, reading, and listening experiences.

**Summary**

1. Writing as a means of communication was not employed very extensively by the pupils. The major writing needs of the pupils, except for writing social letters to friends and relatives, were confined to immediate school needs.

2. Letter writing, except for writing social letters to friends and relatives, was not a particularly important writing activity.

3. Most writing activities were learned in English classes where, of course, such skills are primarily taught.

4. The pupils indicated that interpreting of written material and printed directions, when the occasion to read or use such media presented itself, gave them very little difficulty.

5. The major speech activities of the pupils were conversation and telephoning, along with other informal speech activities.

6. For most speech experience the pupils indicated that self-learning and learning in classes other than English classes were the main learning sources.

7. The main types of informational reading done by the pupils consisted of reading the local newspaper, the morning and evening editions of the nearby metropolitan newspaper along with magazines and textbooks.

8. The principal sources of learning to read newspapers and magazines were self-learning and home learning.

9. Listening to conversation was the major listening activity of the pupils.

10. Self-learning and home learning were the primary sources of learning for listening activities.

11. For most communication activities the pupils tended to rate their effectiveness of use very high.

12. The pupils tended to rate their effectiveness of use higher for those communication activities which they employed most frequently.

13. In general, the girls tended to utilize communication activities slightly more than the boys did.

14. The pupils indicated that English textbooks, especially the classics, were by far the most difficult textbooks to read.

**Recommendations**

1. Efforts should be made to give the significant speaking and listening skills a more representative place in the English program.

2. Conversation and other informal speech experiences which are utilized frequently should be given prominence in English and speech classes.

3. The opportunity to improve reading ability and interests through use of newspapers and magazines should be carefully considered by all teachers of English.

4. Emphasis on teaching listening skills should be increased.

5. Those who conduct English programs need to be fully aware of the possibilities of the use of radio to teach listening skills.

6. The use of informational motion pictures as a teaching and learning device should be extended.

7. Television should not be neglected as a possible instructional device in the field of English communication.

8. It should be clearly demonstrated to pupils that their estimate of their effectiveness of the use of communications skills may be spuriously high and pupils should be given incentives and motivation to attain higher levels of actual performance.

9. Teachers must analyze and identify the different communication needs of individual boys and girls and teach to meet these varying needs.

10. The reasons which make English textbooks difficult to read should be analyzed and taken into consideration by teachers of English.

11. Each teacher, regardless of the subject he teaches, is a teacher of communication and efforts must be made to raise the level of the use of communication skills in all classrooms.

12. Consideration should be given to the eliminating of non-functional communication activities from the secondary school English program and replacing them with functional skills.

Microfilm copy of complete manuscript of 265 pages, \$3.31. Enlargements 6" x 8", 10¢ per page.

**AN EXPERIMENTAL STUDY TO DETERMINE  
STANDARDS OF ORGANIC DEVELOPMENT  
FOR USE IN THE BOYS'  
PHYSICAL EDUCATION PROGRAM IN  
NEW YORK STATE SECONDARY SCHOOLS**

(Publication No. 3624)

Saul Ostrow, Ph.D.  
New York University, 1952

This investigation was undertaken to develop standards of organic development for use in the boys' physical education program in New York State public secondary schools. These standards are

important for evaluating physical fitness and for judging program effectiveness in promoting increased fitness.

First the components of organic development were identified from the literature and classified into three categories: medical, anthropometric, and motor. After eliminating duplication seven components fall in the first category, three in the second, and six in the last.

Next a four-fold criterion of conditions in New York public secondary schools was evolved, and the components of organic development were compared with it to eliminate those which could not be measured because of lack of time, space, equipment, or leadership. Accuracy, agility, balance, body development, endurance, posture, speed, and strength survived this screening.

The literature furnished measures for accuracy, agility, balance, endurance, speed and strength. The best of these measures were tested experimentally and one was retained to evaluate each component. Those chosen were: side-step, target throw, squat-stand, treadmill, 50-yard dash, and chins. For posture a special rating scale was constructed based upon postural standards in the literature. This was tried experimentally, revised and shortened, re-tested and adopted for the final battery. After some difficulty the Wetzel Grid with Wetzel's single-plot screening method was adopted to measure development and nutritional status.

This eight-test battery was then administered to public secondary school boys throughout the State. The results were evaluated by a five-fold criterion of representatives, by comparison with other statewide data, by examination in the light of scientific principles, and by determination of internal consistency. On these bases they were pronounced adequate for the construction of standard scoring scales. Grade was chosen as the basis for these scales.

The tests were correlated with each other and with a criterion consisting of the combined score for all tests excluding nutrition. Then all combinations of two tests were subjected to multiple correlation with the criterion. The combination of strength and speed predicted the criterion best. Twenty-five out of a possible thirty-five three-test combinations were subjected to multiple correlation with the criterion and two combinations: target throw, chins and dash; and chins, dash and squat-stand correlated highest with the criterion. Since the best predictive value of the three-test combination increased only .034 over the best two-test combination, no four-test combinations were tried. Either of the three-test combinations above may be used if a short battery is required.

The final step was computing means for each test on each grade level and smoothing them using regression equations. Then utilizing the standard error of estimate of the regression as a standard deviation, scoring tables were constructed. These standard scoring tables represent standards for organic development.

### Conclusions

1. Age, height, weight and grade are all related in varying degrees to organic development, with age and grade showing the greatest relationship.

2. Organic development of boys increases from grade to grade in grades 7 through 11, but boys in grades 11 and 12 seem to possess approximately the same level of development.

3. Strength and speed appear to be the components which individually reflect most of the total organic development or fitness, and taken together they give a better prediction of organic development than any other combination of two factors.

4. There is a need for a simple nutritional measure that will neither consume too much time to administer nor require special training for administration other than that possessed by a teacher of physical education in the public schools.

Microfilm copy of complete manuscript of 236 pages, \$2.95. Enlargements 6" x 8", 10¢ per page.

### JOSÉ PEDRO VARELA AND HIS CONTRIBUTION TO EDUCATION IN URUGUAY

(Publication No. 3703)

Italo L. Ponterotto, Ph.D.  
New York University, 1951

### The Problem

The purpose in this investigation is to determine the philosophy of education of José Pedro Varela and his contribution to education in the Republic of Uruguay.

### Method

In order to discover Varela's philosophy of education, his works were studied and analyzed. These works include: books, articles, speeches, and memoranda and directives to his subordinates when he was National Inspector of Public Education.

To determine Varela's contributions to education in Uruguay, a study was made of educational conditions in that country before his advent upon the scene and how and to what extent these conditions were changed or modified by Varela's influence. This survey included: school legislation, organization and administration of primary schools, curriculum and methods, preparation of teachers, and facilities in buildings and equipment.

### Findings

In the years prior to 1877 public education in Uruguay was afflicted with poor organization and ineffectual administration and supervision. The curriculum of the primary schools was limited to reading, writing, arithmetic and catechism, and the only method used was the memoriter. Only about 20% of the children of school age were enrolled in the few schools then in existence. The school house was



usually a small rented room with poor lighting and ventilation. The furniture consisted of long tables and backless benches.

These conditions were greatly improved by the educational reform begun in 1877, and which by 1900 had achieved the following results:

1. A system of universal compulsory education was established.
2. The schools were graded and their number increased.
3. Effective administration, control and supervision of schools were organized.
4. An interest in educational matters was fostered in the country at large.
5. The curriculum was enriched.
6. Educational literature was introduced and the ideas of foreign educators were made available in Spanish translation.
7. New methods and techniques were introduced.
8. The preparation and efficiency of the teachers were improved.
9. Improvements were made in school edifices and equipment.

#### Conclusions

The one most responsible for these accomplishments was José Pedro Varela. He conceived the reform of 1877, paved the way for it, and put it into execution.

Varela's interest in education sprang from a desire to bring about the regeneration of Uruguay, to help lead the nation from the path of constant strife, which had consumed its resources and energies, and to help it along the road to peace, prosperity, and progress. He was convinced that the best way to accomplish this was through education, which, if extended to all the inhabitants of the Republic, would make them better citizens of a democratic nation, better producers and consumers, healthier and happier people.

Fired with this belief, and using the example of the United States as the ideal model to be imitated, Varela began to present his views to the nation and urge its people to adopt universal education by establishing the Society of Friends of Public Education, by writing articles, by making speeches, and by publishing his two major works on education, *La Educacion del Pueblo* and *De la Legislación Escolar*.

In 1877 Varela submitted to the government a bill for the reform of public education which, with few modifications, became the law of the land. He was thus responsible for the legislative basis and start of the reform.

From 1877 to 1879 Varela, as head of public education, put into operation the provisions of the law and introduced into the primary schools of Uruguay the new curriculum and the methods which he had borrowed from the United States. He thus established a sound basis for the system of primary instruction which continued to serve the country for many years after his untimely death.

Microfilm copy of complete manuscript of 524 pages, \$6.55. Enlargements 6" x 8", 10¢ per page.

#### THE ACADEMIC BACKGROUNDS OF AGRICULTURAL EXTENSION WORKERS AS RELATED TO SELECTED ASPECTS OF WORK ADJUSTMENT

(Publication No. 3672)

Albert Conrad Posz, Ed.D.  
Michigan State College, 1952

This study was designed to determine the academic status and backgrounds of the County Agricultural Agents and 4-H Club Agents presently employed in Michigan and to determine the relationship between these data and two criteria of work adjustment, work effectiveness and job satisfaction. The five aspects of academic background selected for study were: scores on the American Council on Education Psychological Examination, all-college grade-point averages, number of hours of technical agriculture, technical agriculture grade-point averages, and college majors.

Although the above measures are used by personnel managers and administrators for selection purposes and by counselors for guidance purposes, little attempt has been made to determine the actual vocational significance of these measures. No studies were found which attempted to validate these prognostic measures against criteria of work adjustment in extension work.

The two samples used consisted of 81 County Agents and 48 4-H Club Agents. These agents were ranked into four relatively equal work effectiveness groups by a panel of seven extension administrators. The top three quarters of each group of agents were called "more successful" and the bottom quarter were called "less successful". The two samples were divided into relative satisfaction groups on the basis of the agents' scores on an adaptation of the Hoppock Job Satisfaction Blank.

Data relative to the academic backgrounds of the agents were compiled and presented in tabular form. A study was made of the relationship between the academic factors and work effectiveness. For both samples there were no significant differences between the variable work effectiveness groups with respect to mean ACE scores, mean all-college grade-point averages, mean technical grade-point averages, or mean number of hours of technical agriculture. There were also no significant differences in the success ratings of the agents who majored in various fields of emphasis.

An investigation was made of the relationship between the academic factors and job satisfaction. There were no significant differences found between the variable satisfaction groups with respect to mean ACE scores, mean all-college grade-point averages, mean number of hours of technical agriculture, or mean technical grade-point averages. There were also no significant differences in the job satisfaction scores of the agents who majored in various fields of emphasis in college.

Although there were no significant differences in means on the various academic factors, certain trends were worthy of note. 4-H Club Agents who ranked high on the ACE tended to be less satisfied with their jobs, but also tended to be ranked as

"more successful" in their work. 4-H Club Agents who had high technical grade-point averages tended to be more satisfied and more successful, while County Agricultural Agents with low technical grade-point averages tended to be more satisfied. 4-H Club Agents who had high all-college grade-point averages were rated as more successful. These trends, observable in the extreme ends of the frequency distributions, were not revealed in the arithmetic means.

It would be worthwhile to investigate these trends in a larger group of agents.

Microfilm copy of complete manuscript of 353 pages, \$4.41. Enlargements 6" x 8", 10¢ per page.

THE EDUCATIONAL AND VOCATIONAL PLANS  
OF SENIOR HIGH SCHOOL STUDENTS  
WITH SPECIAL REFERENCE TO THE  
OCCUPATIONAL PATTERN OF THE COMMUNITY,  
THE OCCUPATIONS OF  
HIGH SCHOOL GRADUATES, AND THE TERMINAL  
CURRICULUM OF THE JUNIOR COLLEGE

(Publication No. 3673)

Louis William Redemsky, Ph.D.  
Michigan State College, 1952

The purpose of this study was to determine: (1) Should the junior colleges under consideration offer additional vocational training to meet the expressed needs of their prospective students? (2) If they did offer more vocational terminal curricula, would enrollments increase? (3) What other factors influence students' attendance at the junior colleges?

Four areas were investigated in order to secure information from which conclusions could be drawn. The four areas were: (1) the educational and vocational plans of high school students; (2) the occupations of high school graduates; (3) the occupational patterns of the two communities studied; and (4) an analysis of the junior college curriculum.

Data were secured from questionnaires submitted to a random sample of students of Benton Harbor High School, Benton Harbor, Michigan, and Jackson High School, Jackson, Michigan. The sample was composed of 161 tenth, 165 eleventh, and 118 twelfth grade Benton Harbor students and 194 tenth, 145 eleventh and 111 twelfth grade Jackson students. In addition, a questionnaire was used to secure data from the 1946 and 1949 graduates of the Benton Harbor and Jackson High Schools. Further, the United States Census Data, the Community Job Index, Benton Harbor-St. Joseph, Michigan, and Inventory of Occupational Index, Jackson Labor Market were studied in order to ascertain the occupational patterns of Jackson and Benton Harbor, Michigan.

The Benton Harbor and Jackson Junior College curricula were analyzed in order to determine if vocational-terminal curricula were offered to train students interested in specific occupations, especially semi-professional and skilled occupations.

The data secured from this study indicated: (1)

the number of high school students who expected to attend college was above the national average of high school students who have gone to college in the past; (2) the number of high school graduates from Jackson and Benton Harbor who continued their education was also greater than the national average; (3) a large percent of the high school students who planned to attend college after graduation expected to attend the junior college; (4) others stated they would attend the junior college if courses were offered to train them for the particular occupation which they intended to pursue; (5) more high school graduates would attend the junior college if training could be secured for the semi-professional and skilled occupations; (6) the junior colleges are now serving the needs of students interested in a two-year educational program previous to attendance at a senior college; (7) it seems that the facilities for guidance and counseling should be expanded to include more occupational information because a larger number of high school students aspire to professional occupations than are likely ever to engage in these occupations; (8) inasmuch as high school students were not informed about occupational requirements, the uncertainties of finding employment in some occupations and the occupational training offered in the junior college, the high school guidance and counseling program needs to include more information which would broaden the students' knowledge about these matters; (9) more students would attend the junior college if tuition and textbooks were free; (10) an intensified public relations program is necessary to enlighten the community about the training the junior colleges now offer; (11) factors which influence high school graduates to attend the junior college are reduced financial cost, the desirability of remaining at home, and the possibility of preparing for a vocation; and (12) an increase in enrollment could be expected in the junior colleges if more curricula were offered for individuals interested in part-time education.

Microfilm copy of complete manuscript of 356 pages, \$4.45. Enlargements 6" x 8", 10¢ per page.

THE OPINIONS OF THE CHIEF STATE  
SCHOOL OFFICERS IN MISSOURI  
AS TO STATE SCHOOL ADMINISTRATION

(Publication No. 3855)

George Sylvester Reuter, Jr., Ed.D.  
University of Missouri, 1952

Purpose

To interpret the opinions of the chief state school officers in Missouri as to state school administration by tracing the lives, personalities, academic training, and experience of the twenty fulltime chief state school officers, from 1839 to 1947.

Method of Research

The historical method of research was used. Newspapers of the period, dissertations, books, the



reports of the chief state school officer and the secretary of state, and various publications were studied.

#### Summary

1. The first chief state school officer in Missouri was called the "Superintendent of Common Schools," and this title remained until 1865. The Geyer Act of 1839 provided for the first title and the selection by the General Assembly.

2. The Secretary of State served ex-officio as the chief state school officer from 1841 to 1854 and from 1861 to 1865.

3. The Kelly Act of 1853 reestablished the chief state school officer on a full-time basis. Popular election by the people every two years was established.

4. The office was reestablished in 1865 as "Superintendent of Public Instruction."

5. The Constitution of 1865 and the Laws of 1866 provided for the popular election of the chief state school officer every four years.

6. The Constitution of 1875 changed the title to "Superintendent of Public Schools."

7. The Constitution of 1945 provided for an appointed chief state school officer.

8. Glover, Henry, Baker, and Scantlin were political leaders. Henry, Divoll, Shannon, Kirk, and Lamkin were lawyers. Davis was a newspaper publisher, while Shannon was a physician. Robinson, Parker, and Monteith were clergymen. Shannon, Kirk, Carrington, and Lamkin were college presidents. Lamkin, Lee, King, and Scantlin are alive. Sixteen counties in all sections of Missouri produced these twenty men.

9. The staff of the chief state school officer increased from nothing to one hundred and seven in 1942.

10. Teachers' institutes were advocated by chief state school officers since 1850, and the law was enacted in 1891.

11. Starke recommended the county teachers association in 1859, and the law was enacted in 1903.

12. The Crossley-Snodgrass Teacher Training Law was enacted in 1913 after being recommended by the chief state school officers.

13. Five Normal Schools were established after being recommended by the chief state school officers. Lincoln Institute was also established.

14. County textbook adoption existed from 1874 to 1885. State adoption followed from 1891 to 1905, but county adoption was returned to in 1907. Each change in method was recommended by the various chief state school officers.

15. The County Supervision Law was enacted in 1909. Broader State supervision developed later, but both were recommended by the chief state school officers.

16. Kirk was first to discuss buildings, equipment, and sanitary regulations. Lee advocated teacherages. A director of school building service was established in 1932.

17. The Compulsory Attendance Law was enacted in 1905. Revisions were made in 1919 and 1933. The

chief state school officers made a series of recommendations on this subject.

#### Conclusions

1. The chief state school officers have been a powerful influence in securing legislation from the General Assembly.

2. The chief state school officers have promoted educational progress in Missouri from 1839 to 1947.

3. The chief state school officers have been in harmony with national, state, and local educational practices.

4. The chief state school officers have been working through the years for a closer acceptance of practices that satisfied the general public in a democratic way.

5. The chief state school officers have shown greater success in educational expansion since 1900.

6. The chief state school officers, because of their diversity of training and experience, have been able to conduct State administration without serious sectional trouble.

7. Some of the chief state school officers, after being concerned with State administration, have gone to other executive educational positions.

8. The chief state school officers have developed one phase of education until another way was presented, thus promoting institutes, teacher training, county and State teachers associations, county and State supervision and administration, and Normal Schools to State Colleges.

9. The chief state school officers have aided in securing free public education through the high school.

10. The chief state school officers have aided in securing special educational benefits for children needing special attention.

11. The chief state school officers have constantly worked for equal educational opportunities for all youth in Missouri.

12. The chief state school officers have aided in securing transportation benefits.

13. The chief state school officers have worked for larger school units with broader curricula and educational facilities.

14. The chief state school officers have achieved progress by constitutional, judicial, legislative, and extra-legal methods.

15. And, finally, a critical study of the opinions of the chief state school officers in Missouri reveals clearly and forcefully the leadership these twenty educators have played in securing continued progress in State school administration.

Microfilm copy of complete manuscript of 356 pages, \$4.45. Enlargements 6" x 8", 10¢ per page.

**A STUDY OF THE READINESS OF AMERICAN  
BAPTIST THEOLOGICAL STUDENTS  
HOLDING OPPOSING "FUNDAMENTALIST" AND  
"MODERNIST" THEOLOGICAL VIEWS TO  
ASSOCIATE IN RELIGIOUS GROUPS WITH  
THOSE DIFFERING FROM THEMSELVES**

(Publication No. 3797)

Harold Wellington Richardson, Ph.D.  
University of Michigan, 1952

This study was stimulated by the withdrawal behavior of individuals and churches of the American (formerly Northern) Baptist Convention, avowedly based on doctrinal considerations. It was projected for the purpose of establishing the degree of relationship that might exist between readiness to associate with those who differ, on the one hand, with certain personality factors, on the other; and between readiness and doctrinal position between the "fundamentalist" and "modernist" extremes.

The principal recent studies of religious conservatism-radicalism and of attitude measurement methods were reviewed, and An Inventory of Doctrinal Emphasis and Associative Readiness constructed in two parts. Part I, a measure of modernist-fundamentalist belief, assumes the existence of a family of concepts, expressed as doctrinal affirmations, along a single continuum between the two extremes. It was constructed largely by the Likert method, with the addition of a jury process as an aid in validation and scoring. Thirty pairs of opposing statements on modernist-fundamentalist issues were presented, each pair with a five-point scale for showing nearness of one's belief to either statement. These were reduced to twenty-four pairs by a test of internal consistency.

Part II, a measure of associative tendency, was made by presenting the sixty statements from the thirty pairs in random order, with directions to indicate on a five-point scale readiness or unreadiness to associate with a ministerial group where each statement in turn was assumed to be a predominant view. With the reduction of Part I to twenty-four pairs, Part II was correspondingly reduced to the forty-eight component statements.

These two instruments, with the Guilford-Martin Personnel Inventory, measuring Objectivity, Agreeableness, and Cooperativeness, and a Personal Data form, were administered to 141 third year graduate theological students in seven of the eight standard seminaries of the American Baptist Convention.

A bi-modal distribution of Part I scores included scores throughout the full 96-point range, with a mean of 48.2, and standard deviation of 32.5; the modes were at 18 and 84. The Part II distribution approximated normality, with a mean of 41.8 and S.D. of 18.0. The Pearson  $r$  for I and II was .454. Regression of II on I was non linear;  $\eta_{II, I}^2 = .600$ ;  $\eta_{I, II}^2 = .515$ . Differences of means of highest and lowest quartiles on either distribution for the opposite factor, and the  $r$ , all proved significant at the 1 percent level of confidence. Split-half reliability coefficients for both Part I and Part II were about .95.

With less significance Part II (unreadiness) was related negatively to Objectivity and Cooperativeness, and again at the 1 percent level with report of having had a conversion experience and with "clear call of God" against "service to fellowmen" as motive for entering the ministry.

Part I (fundamentalism) was also strongly related to conversion experience; to "clear call of God" as motive, as against both "service" and "influence of adults." Neither age nor marital status was significantly related to Part I or Part II responses. American (Northern) Baptists were more ready than the few Southern Baptists in the sample to associate with those who differ from themselves.

Part I and Part II of the Inventory of Doctrinal Emphasis and Associative Readiness, or later refinements of them, are recommended for use in the guidance of theological students by the graduate seminaries. This recommendation is based on the assumption that an extreme degree of unreadiness to associate with those who differ is in itself a personality characteristic which may affect adversely the quality of a student's future pastoral leadership.

Microfilm copy of complete manuscript of 202 pages, \$2.53. Enlargements 6" x 8", 10¢ per page.

**EDUCATIONAL NEEDS AND INTERESTS OF  
PEOPLE CONCERNING THE SELECTION,  
OPERATION, AND CARE OF THE AUTOMOBILE**

(Publication No. 3857)

Elmer Robert Rudiger, Ed.D.  
University of Missouri, 1952

**Purpose**

The major purposes of this study were: (1) to ascertain the educational needs of people concerning the selection, operation, and care of automobiles, (2) to ascertain their interests and preferences with respect to learning more about the selection, operation, and care of automobiles, and (3) to furnish data upon which school authorities may organize automotive instruction in high school and in adult education programs.

**Method of Research**

Information blanks were sent to 1147 automobile owners, 547 service managers, 18 automobile manufacturers, and 139 driver trainers. The responses to the items on the information blanks were tabulated according to category and source. The data from these information blanks plus the available literature on automotive instruction comprised the information upon which this study was based.

**Summary and Conclusions**

1. There are certain fundamentals of motor car construction and operation which, if understood by people, would enable them to better select, operate, and care for their automobiles.

2. Most people know very little about automobile



selection, operation, and care; they would benefit from some form of instruction dealing with these activities.

3. Although the need for educating people in the proper selection, operation, and care of the automobile has existed for many years, the public schools unfortunately have done very little toward providing this training.

4. One of the largest single investments most people make is the purchase of an automobile, yet people generally do not select, operate, or care for their automobiles in a manner advantageous to them.

5. Most people would like to learn more about automobile selection, operation, and care providing they could do so in a way that would be convenient and inexpensive.

6. There is a need for courses dealing with automobile selection, operation, and care in public high schools and in adult education programs.

7. It is more important that people learn how to determine when their automobile needs adjustment and repairs than it is for them to know how to do the actual repairs themselves.

8. There is a need for more comprehensive courses in Missouri public high schools relative to non-vocational automotive instruction.

9. The major emphasis in non-vocational automotive instruction should first be upon safe and economical operation, with proper care and maintenance, and intelligent selection ranking second and third in order.

#### Recommendations

1. Present non-vocational automotive courses should be expanded to include instruction in the selection and care of the automobile, as well as safe and economical operation.

2. All high school pupils should have an opportunity to enroll in a course dealing with automobile selection, operation, and care.

3. Adequate class time should be allotted for non-vocational automotive instruction, and the courses should carry credit toward graduation on the same basis as other subjects in the high school program.

4. Adequate classroom space and equipment should be provided for teaching automobile selection, operation, and care. Among the items of equipment should be an automobile for behind-the-wheel driving and models, mock-ups, and cut-a-ways of automobile parts for demonstration purposes.

5. Teacher training institutions should expand their programs to include instruction dealing with automobile selection, operation, and care.

6. Agencies engaged in adult education should include as a part of their program instruction dealing with the selection, operation, and care of the automobile.

7. Reasonable total teacher load should be kept in mind when scheduling the staff for instruction dealing with automobile selection, operation, and care.

8. Funds for non-vocational automotive instruction in the public high schools should come from the

same source and be a part of the total amount budgeted for the whole school program.

Microfilm copy of complete manuscript of 194 pages, \$2.43. Enlargements 6" x 8", 10¢ per page.

#### PROFESSIONAL IN-SERVICE IMPROVEMENT OF TEACHERS IN MISSOURI

(Publication No. 3860)

Robb Lillard Shanks, Ed.D.  
University of Missouri, 1952

#### Purpose

The purpose of this study is to determine what the teachers of Missouri are doing for professional improvement.

#### Method of Research

The major portion of the primary data for this study were obtained by the normative-survey method. The 1068 Information Blanks were filled out by superintendents, principals, high school teachers and elementary teachers.

#### Conclusions

On the basis of the facts presented in this study, in so far as they are representative, the following conclusions seem pertinent.

1. Teaching will not become a profession as long as there is a significant percentage of the teachers working toward certification.

2. The administrators of Missouri have not worked systematically toward certification in their administrative capacities.

3. The teachers and administration have not had a desirable tenure program.

4. The teachers and administrators held a desirable professional attitude in that the personnel who were not fully qualified desired to fulfill the requirements of their position.

5. The teachers and administrators held a desirable feeling of professional responsibility in that their most popular reason for taking academic and professional courses was "to be able to teach more efficiently."

6. It seems probable that more college teachers would come from the ranks of superintendents, high school principals and high school teachers.

7. The majority of the teachers and administrators do not consider their present employment status permanent.

8. The majority of teachers and administrators will probably remain on their present level of teaching.

9. School authorities should probably not require teachers to attend any more than summer school for further formal institutional training.

10. The institutions of Missouri could develop summer extension classes more extensively.

11. The teachers and administrators show the

desirable professional attribute of trying to keep informed on current professional problems.

12. The Missouri State Teachers Association and the National Education Association should attempt to develop their local and community education associations more extensively.

13. The teachers training institutions and the local school agencies should develop a more extensive program for teachers' workshops.

14. School authorities should not make attendance of teachers' workshops compulsory.

15. The supervisory visits and conferences need improving by developing a better understanding of the requirements of supervision.

16. Missouri teachers need more adequate leadership by a specially trained administrative group qualified to lead the teachers.

17. The teachers would willingly support a committee in which they could see the possibility of realizing a personal gain in the profession more than they would general research problems that would not necessarily make them realize some personal gains.

18. The administrators and supervisors should make known their attitude toward research to the teachers to get more constructive work in that area.

19. The teachers are in need of enlightened guidance and leadership in individual activities such as experimentation with new classroom procedures.

20. An interesting phase of an in-service program could be built up by developing intervisitation of classes in home schools.

21. There is not enough encouragement from a financial standpoint for the teachers and administrators to achieve a higher level of training or other professional improvement.

22. The teachers and administrators must enlighten the public and the boards of education as to how an improved teaching profession could result from the provisions of leaves of absence and adequate financial means for professional improvement.

23. The teachers and administrators should be given an adequate salary so that it would not be necessary to supplement their income from teaching.

Microfilm copy of complete manuscript of 244 pages, \$3.05. Enlargements 6" x 8", 10¢ per page.

#### THE RELATIONSHIP OF READING ABILITY TO MEASURES OF PERCEPTUAL SPAN WITH SPECIAL REFERENCE TO TACHISTOSCOPIC SPAN FOR DIGITS

(Publication No. 3805)

Roy Elmer Sommerfeld, Ph.D.  
University of Michigan, 1952

The purpose of this study was to discover whether the relationships between measures of perception span, particularly tachistoscopic span for digits, and measures of reading achievement are high enough to

justify efforts to improve reading ability by means of short-exposure training methods.

Subjects of the experiment were ninety-seven students from classes in Educational Psychology at the University of Michigan. The measures employed were: (1) threshold span for digits, (2) modified-threshold span for digits, (3) mean span for digits, (4) span for words, (5) a words-per-minute score from three 1,000-word passages, (6) the vocabulary score, (7) the level-of-comprehension score, and (8) the speed-of-comprehension score from the Cooperative English Test, Test C2: Reading Comprehension. The following measures were obtained from eye-movement records: (9) total fixations on a passage of Grade II material, (10) total fixations on a passage of Grade XII level difficulty, (11) the time required to read the Grade II passage, (12) the time required to read the Grade XII passage. Pearson  $r$ 's were run between various combinations of these measures.

The specific findings may be summarized as follows: (1) The intercorrelations of the measures of tachistoscopic span for digits were positive and statistically significant. (2) A significant but low correlation was found between the modified-threshold span for digits and tachistoscopic span for words; correlations between tachistoscopic span for words and the two other measures of digit span were not significant. (3) A significant but low correlation was found between the modified-threshold span for digits and the size of the fixations on the Grade II passage; correlations between the other measures of digit span and fixation span were not significant. (4) The correlation between tachistoscopic span for words and fixation span on the Grade II passage was significant but low; the correlation between span for words and the size of the fixations on the Grade XII passage was not significant. (5) No significant correlations were found between the various measures of digit span and rate of reading. (6) No conclusive evidence was found of a relationship between tachistoscopic span for words and rate. (7) Significant correlations appeared between the size of the fixations in normal reading and rate. (8) The correlations between the measures of tachistoscopic span for digits and measures of comprehension were not statistically significant. (9) The correlations between tachistoscopic span for words and comprehension were not significant. (10) A significant but low correlation was found between the size of the fixations on the Grade II passage and speed of comprehension; the correlations between the size of the fixations on the Grade XII passage and speed of comprehension and between level of comprehension and the two measures of the size of the fixations were not statistically significant.

The principal conclusion to be drawn from the results of this study is that no significant relationship was found for this population between the measures of tachistoscopic span and the measures of reading ability as employed in this study. It follows by implication that short-exposure training cannot, in and of itself, influence the process of normal reading except as certain secondary factors, such as motivation, not inherent to the training method are involved.

Microfilm copy of complete manuscript of 171 pages, \$2.14. Enlargements 6" x 8", 10¢ per page.



**HOPE COLLEGE IN  
DUTCH-AMERICAN LIFE, 1851-1951**

(Publication No. 3806)

Preston Jay Stegenga, Ph.D.  
University of Michigan, 1952

The purpose of this study is to determine the role of Hope College, a denominational institution, in the assimilation of a European national group to American life. Hope College was founded in 1851 in Holland, Michigan, by Dutch colonists in cooperation with the Reformed Church in America. The study places a major emphasis upon the relationships between the college and the denomination. To understand these relationships, it attempts to examine the actions, opinions, and influences of the Dutch pioneers, of denominational groups and leaders, as well as those of other groups and pressures outside the church.

The basic inquiry of the study relates to the hypothesis that Hope College has departed to some extent from its original aims and practices. Despite the opposition of strong pressures from within the denomination, changes in tradition have arisen as a result of the gradual Americanization of the Hollanders as a part of the attempt of groups and individuals to adjust to their environment. In order to test this hypothesis, each phase of the Hope College program is considered. For example, the growth of sectarian and secular trends in the college curriculum is studied. It is noted that originally the academic program stressed perpetuation of Dutch religious and cultural heritage, as it emphasized theological training and Dutch language instruction. However, as the college developed, there are evidences of increasing pressures for the modification of the curriculum to meet changing sectarian and secular demands.

When the various modifications of all the phases of the college program are considered as a unified inter-related unit, it is evident that Hope College has been a factor in the assimilation of the Dutch to American life. While the college and its closely-related Dutch community have steadily expanded, the process of Americanization has likewise evolved throughout the decades as a result of diverse denominational and non-denominational pressures. It is also apparent that Hope College has not turned to complete non-denominational controls, nor has it remained entirely church dominated. Results of the study indicate that the college has followed a "middle of the road" course between these two extremes.

It is concluded from this study that Hope College, as an American denominational college founded by a European national group, has felt the pressures of various groups and individuals, sectarian and secular, conservative as well as liberal. Although there are indications that non-denominational pressures have steadily increased, the Reformed Church in America continues to be a dominant influence in the college program. Thus, on the one hand, retention of the central core of religious and Dutch heritage indicates preservation of some aspects of Dutch-American life. On the other hand, however, various

modifications in the Hope College program indicate an attempt to adjust to the emerging needs of modern society.

Microfilm copy of complete manuscript of 374 pages, \$4.68. Enlargements 6" x 8", 10¢ per page.

**A STUDY OF THE RELATION BETWEEN  
THE EQUIPMENT OF COMMERCIAL TEACHERS  
AND THE DEMANDS OF THEIR  
TEACHING SITUATIONS**

(Publication No. 3818)

John Melvin Trytten, Ph.D.  
University of Michigan, 1943

This is a study of the nature of the duties of business teachers, and an evaluation of the effectiveness of six training influences: general education courses, methods courses, student teaching, business experience, teaching experience, and in-service study. Data were collected by questionnaire from 235 business teachers and from 31 high school principals. Eighteen issues raised by the study were submitted to 41 authorities in the field of business education. The investigator presents 19 conclusions and makes nine recommendations.

Several of the conclusions are confirmations of observations frequently heard: that a significant number of teachers have a narrow concept of education; that they persist in loyalty to the few traditional office skills; and that they are content to pass on to students their learning as they received it, justifying the criticism that they are preparing students for the business world of yesterday.

Important conclusions are: (1) The number and variety of demands depend upon the initiative of the teachers, and vary with the capacities of teachers for sensing the demands and with their readiness to respond to them. (2) General education is of value to the extent that teaching objectives go beyond specific skills and specialized subject matter to the development of students as persons. (3) Student teaching of the type experienced by the respondents is of doubtful value as a part of teacher education. (4) Business experience contributes significance to subject matter, and makes for poise, and confidence, but in the area studied it is neither feasible nor necessary to arrange for the teacher to have business experience specifically related to a given subject. (5) The education of business teachers must be planned to extend beyond the pre-service period, to continue through the teaching years, with provision for competent supervision to stimulate and direct the continued growth throughout the teaching period.

Significant recommendations of the investigator are: (1) Practice teaching experiences of business teachers should involve control of techniques of adjusting to situations which will confront them with unexpected demands. These demands may be the need to build up gaps in subject matter preparation, the determination of specific objectives, the organization of

teaching materials, and the appraisal of teaching performance, in connection with new teaching assignments. (2) Efforts to make business experience available to prospective teachers, and to teachers in service should be made by teacher training schools, by local office managers and by association of business teachers. The acquisition of such experience should be encouraged by applying business experience toward improved status, salary increases, or towards meeting requirements for the renewal of a teaching certificate. (3) Provision should be made for the supervision during at least the first year of the novice's teaching experience. This should be a cooperative responsibility of the school which granted the certificate, and the administration of the local high school. (4) Institutions for teacher education must appraise their programs to determine the extent to which their cultural elements are likely to attract able and colorful students, and to enable them as teachers to help their pupils lead rich, interesting lives.

Microfilm copy of complete manuscript of 277 pages, \$3.46. Enlargements 6" x 8", 10¢ per page.

**A STUDY TO DETERMINE  
WHY FRESHMAN SCHOLARSHIP STUDENTS  
AT MICHIGAN STATE COLLEGE  
FAIL TO RENEW THEIR SCHOLARSHIPS**

(Publication No. 3674)

Marvin Chesley Volpel, Ed.D.  
Michigan State College, 1952

During the academic year 1949-1950 there were 386 freshmen studying at Michigan State College under the terms of the entrance scholarship. The terms of the scholarship specify; first, that the regular tuition fees be waived upon entrance and each term thereafter, if the student maintains a one-point six (C+) average at the close of each academic year in June; and second, that no student may participate in these scholarships for more than 12 quarters. At the end of the freshman year, it was found that 41 per cent of those freshmen failed to earn a renewal of the scholarship award. This alarming figure presented a problem which warranted an investigation.

For some long time, colleges have made tuition-free awards to deserving high school graduates but only in the past few years have they given them in such large numbers. The problem presented here stems from this fact and consequently from the fact that little research has been undertaken regarding the success of scholarship students. A survey of the literature failed to uncover any study similar to this investigation.

This study was undertaken to determine, if possible, why so many freshmen, presumably of good high school backgrounds, did not maintain the grade point average required for the renewal. The writer investigated the high school and first year college records of 586 students. These are divided into

groups of (a) 33 students who withdrew sometime during the year, (b) 158 students whose scholarships were cancelled at the end of the year, (c) 195 students whose scholarships were renewed, and (d) 200 regular freshmen selected at random. To supplement this material and to furnish some subjective evidence for the research, the writer administered a questionnaire to the members of the several groups mentioned.

The questions which follow serve as guideposts for the investigation to determine why 41 per cent of these freshmen failed to renew their scholarships. Is it the fault of the high school in failing to prepare its graduates for college work? Is it the fault of the college in failing to meet its obligations to the student? Is it the fault of the student himself in failing to meet the responsibilities his new environment requires? Are there other reasons why these students did not do well in college? And can anything be done to remedy the situation? The answers to these questions should prove beneficial to guidance officials in both secondary schools and colleges in order that they might promote better adjustment of college freshmen.

The evidence studied in this investigation revealed numerous conclusions, a few of which are summarized here:

1. More than half of those who lost their scholarships came from small high schools. The more successful students came from large high schools which were accredited by the North Central Association.
2. Those who lost their scholarships had lower high school averages and scored way below the renewal students on the Psychological Examinations. As a group they were not bright students in the first place.
3. Fifty-nine per cent of the cancellation students were dissatisfied with the comprehensive examination system.
4. The cancellation students stated that they lacked interest in their classes and expressed apathy in general toward college work. On the other hand, the renewal students were interested in achieving their goals and earning a renewal of the award.
5. Outside employment was definitely a cause of many scholarship cancellations.
6. Those who lost their scholarships stated that the study facilities in their respective dormitories were very unsatisfactory.
7. The scholarship students themselves attribute the loss of their scholarships to their ineffective habits of study.

Microfilm copy of complete manuscript of 282 pages, \$3.53. Enlargements 6" x 8", 10¢ per page.



# ELEMENTARY MATHEMATICS IN ARTS COLLEGES

(Publication No. 3895)

Howard Elmer Wahlert, Ph.D.  
Columbia University, 1952

It is the purpose of this study to investigate the influences that have affected the teaching of elementary mathematics in liberal arts colleges. The historical development of college mathematics courses is traced from small beginnings at Harvard in 1636. The discoveries in mathematics in the seventeenth and eighteenth centuries were gradually included in the college courses. Mathematics began to occupy a larger place in the college curriculum and gradually came to be viewed as a basic subject and as part of a traditional liberal arts curriculum.

In the nineteenth century the development of secondary schools made it possible to move elementary parts of mathematics to these schools and to require this material for college entrance. The growth of knowledge in this century made it impossible to require every college course of every student, and so the elective system developed. Mathematics, by this time, had a well established traditional position, and, in the then current educational philosophy, it was viewed as an especially valuable mental discipline. In spite of the growth of the physical sciences, the practical value of mathematics was considered of little significance compared to its value as a mental discipline.

The increase in knowledge in the twentieth century caused more and more courses to be introduced in the colleges. Critical evaluation of the contribution of each branch of knowledge in a liberal arts education and new psychologies and philosophies of education raised questions concerning the traditional subjects and their relevance to modern civilization. Many changes have taken place in college mathematics courses in the past fifty years. Alongside the traditional courses in mathematics there have developed survey courses in mathematics, some intended as preparation for further work in mathematics and the sciences, some as terminal courses as part of a basic liberal arts core curriculum. In all elementary college mathematics much more attention is paid to applications of mathematics. Applications to the physical sciences are now well established in mathematics courses. Other applications, especially those involving statistics, seem to be finding a place in college mathematics. In addition, the broad relations between mathematics and our culture and the basic characteristics of logical reasoning are receiving more emphasis in elementary mathematics courses.

Many individuals and some colleges have given considerable thought to the question of the proper position and content of mathematics in a liberal arts education. Such opinions have been expressed in textbooks and in articles in various journals. However, there has never been a study of the problem comparable to the studies of the problem on the secondary level by committees of the Mathematical

Association of America and the National Council of Teachers of Mathematics. The study of this problem by many college teachers sharing their opinions and experience might facilitate the improvement of the teaching of elementary college mathematics.

Microfilm copy of complete manuscript of 154 pages, \$1.93. Enlargements 6" x 8", 10¢ per page.

# RELATIONSHIP OF EYE-HAND COORDINATION IN CHILDREN TO TOTAL DEVELOPMENT

(Publication No. 3817)

Wilbur Allen Williams, Ph.D.  
University of Michigan, 1952

One-hundred forty-nine children, aged six through twelve years, were used as subjects in a study of the relationship of eye-hand coordination to other aspects of child development. Five questions were investigated: (1) Does eye-hand coordination tend to fall within the cluster of other growth aspects? (2) Is eye-hand coordination of girls superior to that of boys? (3) Do children who exhibit greater readiness for formal instruction in reading also exhibit eye-hand coordination superior to that of children who show relatively little reading readiness? (4) Do children who exhibit great variability in their growth aspects show slower performance in eye-hand coordination than children who show little variability? (5) Do siblings exhibit greater similarity in the development of eye-hand coordination than unrelated children?

The instrument used to determine the extent of development in eye-hand coordination was the speed portion of the Moore Eye-Hand Coordination and Color Matching Test. An eye-hand coordination age for each subject was derived on the basis of his performance on this test.

Since the subjects were a part of the longitudinal growth studies carried on at the University Elementary School, Ann Arbor, Michigan, the following growth ages were available for the majority of them: height age, weight age, grip age, dental age, carpal age, mental age, and reading age. Examination of 110 profiles of children upon whom three or more growth ages were available revealed that eye-hand coordination age fell within the cluster of growth ages in 67 percent of the cases. Intercorrelations and partial correlations were computed on 94 children on whom all seven growth ages were available with these results: (1) While positive correlations were obtained between eye-hand coordination age and other growth ages, these were smaller than those between each of the other growth ages. (2) When chronological age was held constant a partial correlation coefficient of  $-.21$  between eye-hand coordination and mental age was significant at the 5 percent level.

A comparison of speed of eye-hand coordination of girls and boys revealed a trend for girls to perform Moore's test more rapidly than boys.

A rank difference correlation coefficient of  $+.41$

was obtained between the speed of eye-hand coordination of seventeen Kindergarten children and their scores on the reading readiness sections of the Metropolitan Readiness Test. This suggested a tendency for those who exhibit greater readiness for reading instruction to perform Moore's test more rapidly than those who show little readiness in this area.

The standard deviations for each of 99 children were computed on the seven growth ages. A comparison made between eye-hand coordination and variability in growth ages revealed no apparent trend for children at either extreme in variability to perform the test more speedily than others.

A study of the eye-hand coordination quotients of 26 siblings and 26 non-siblings matched for age and sex was made using computation of t-value, correlational technique and graphic portrayal. A trend was noted for the eye-hand quotients of siblings to be more directly related than those of unrelated children.

Microfilm copy of complete manuscript of 123 pages, \$1.54. Enlargements 6" x 8", 10¢ per page.

#### A SYNTHESIS AND EVALUATION OF SUBJECT-MATTER TOPICS IN MATHEMATICS FOR GENERAL EDUCATION

(Publication No. 3821)

Lauren Gayle Woodby, Ph.D.  
University of Michigan, 1952

#### The Problem

The purpose of this investigation is to synthesize a comprehensive list of subject-matter topics in general mathematics and to determine the relative values of these topics for general education in grades VII-XIV.

#### The Method

The first part of the investigation consisted of the compilation of a list of topics from terminal courses in general mathematics at the junior college level and an evaluation of these topics as to their relative worth for general education. The catalogues of 468 colleges were examined to find terminal courses that appeared to be designed for general education. A questionnaire was sent to each of the 101 institutions found to offer such a course, to obtain information about the basic materials used in the course and to request a copy of the syllabus for the course. Sixty-two usable replies were received, and 17 syllabi accompanied them. A list was compiled of all the different mathematical topics found in the 17 syllabi and in the 6 textbooks whose use had been most frequently reported on the questionnaire returns. To this list, 27 topics suggested by a specialist in the teaching of mathematics at the University of Michigan were added. The composite list thus obtained included 570 topics. Each of these topics was evaluated with respect to its suitability

for inclusion in a junior college course in general mathematics designed for general education. This evaluation was made by a jury consisting of 10 specialists in mathematics and 9 specialists in the teaching of mathematics.

The second part of the investigation consisted of a synthesis of the subject-matter topics that were determined in 10 studies — 9 previously reported ones and the study just described. All the topics that were named in all the 10 contributing sources were organized into a composite outline along with their values as indicated in the respective sources. The 1077 different topics that constituted the composite outline were ranked within each source.

The 10 contributing sources were evaluated by a jury of 10 specialists in educational research, and a relative weight was determined for each source. For each topic the product of its rank within a source and the relative weight of that source was considered to be its relative value in that source. The aggregate value for each topic was determined and then reduced to a more convenient index value, namely, a percent of the highest aggregate value found. Index values were thus determined for the 1077 topics in the composite outline.

#### Recommendation

Because the index values of the topics provide an objective basis for the selection of mathematical topics suitable for general education, it is recommended that the list of 1077 topics found in the synthesis be considered as a source of topics in mathematics by teachers, curriculum workers, and writers of textbooks.

Microfilm copy of complete manuscript of 238 pages, \$2.98. Enlargements 6" x 8", 10¢ per page.

#### A STUDY OF SOME HEALTH MISCONCEPTIONS OF PROSPECTIVE TEACHERS IN NEGRO COLLEGES OF NORTH CAROLINA

(Publication No. 3680)

Maude Josephine Yancey, Ed.D.  
University of Michigan, 1952

The improvement of health education in the preparation of prospective teachers requires a knowledge of the kind of health beliefs to which they subscribe. The problem of this study is to discover some of the health misconceptions held by prospective secondary and elementary teachers in Negro colleges of North Carolina, the prevalence of these misconceptions treated in this study relate to major problem areas of health in North Carolina. The selected areas are nutrition, alcohol and tobacco, mental health, sex education, venereal diseases, tuberculosis, chronic diseases, personal and environmental health, oral health, other communicable diseases, and maternal and child health. The factors considered in relation to the prevalence of misconceptions are the problem areas represented, the college attended, the sex,



classification, field of specialization, and residence of the student.

The general method of investigation was the normative-survey. A true-false type of check list was the major instrument used in the collection of data. This check list was tested for validity, reliability, and understandability by use of a trial test, the jury technique, and interviews. The investigator administered the test instrument to 1115 prospective teachers in Negro colleges of North Carolina.

The data collected were analyzed both statistically and descriptively. The statistical treatment was confined to those procedures that indicate the general prevalence of misconceptions and the significant differences in the prevalence of misconceptions as related to the factors studied. The most prevalent and the least prevalent misconceptions were described in reference to the same factors.

Analysis of the data showed that belief in health misconceptions was prevalent among all groups studied. Although there were differences in the number of unfounded beliefs held by different groups of prospective teachers, the marked prevalence of these misconceptions was not influenced greatly by the college attended, the sex, classification, or the field of specialization of the student. The most popular misconceptions in one group of prospective teachers were generally the most popular in the other groups. The findings indicated that many misconceptions relating to each of the selected problem areas were believed by the prospective teachers in Negro colleges of North Carolina. Misconceptions were more prevalent, however, in the areas of personal and environmental health and tuberculosis than in the other areas.

The existence of many health misconceptions among prospective secondary and elementary teachers in Negro colleges of North Carolina indicates a need for specific instruction directed toward the elimination of unfounded beliefs about health.

Microfilm copy of complete manuscript of 250 pages, \$3.13. Enlargements 6" x 8", 10¢ per page.

## EDUCATION AND PSYCHOLOGY

### A PERSONALITY STUDY OF INDIVIDUALS WITH SEEN AND UNSEEN PHYSICAL HANDICAPS

(Publication No. 3605)

Jules Barron, Ph.D.  
New York University, 1952

The purpose of this study was to determine the relationship between aspects of personality and the observability of the physical handicap. The hypoth-

esis tested was that there will be differences in aspects of personality of physically handicapped individuals which can be related to the seen or unseen nature of the handicap.

Thirty white, male, physically handicapped patients between the ages of 17 and 44 were studied by a clinical, qualitative analysis of their Wechsler-Bellevue, Sentence Completion and Rorschach test performances. There were two groups of patients; fifteen with observable disabilities and fifteen with unseen disabilities. Each diagnosis was established by the physician supervising the case under the auspices of the New Jersey State Rehabilitation Commission.

The two groups were equated on the basis of age, education, and age of onset of handicap. The variables of sex and color also were held constant for both groups.

The groups were analyzed by 1) setting up and defining personality characteristics in the form of judgment categories, 2) these characteristics were judged in terms of presence or absence, 3) judgments were made independently by two qualified clinical psychologists, 4) when significance of agreement was not obtained between judges with regard to several characteristics all characteristics were redefined and judgments made again, 5) the direct method of obtaining probability was used to establish the significance of agreement between judges, 6) when lack of agreement persisted, following the rejudgments, the particular characteristic was discarded and regarded as not capable of being judged reliably, 7) the direct method of analysis was employed to compare the groups with regard to those characteristics which yielded significant inter-judge reliability, 8) qualitative indicators as they were determined from the research were listed and discussed.

Each subject was analyzed individually by clinically evaluating him in terms of the dynamic and global constellation of characteristics peculiar to the individual.

Of the fifty-two selected characteristics that were rated by the judges, ten were judged with significant inter-judge reliability. Of these ten reliable items, two were found to yield significant differences between groups, each on the basis of a single judge's ratings.

The results revealed significance of agreement between judges at the 5 per cent level of confidence on the following characteristics: 1) too high goals, 2) resistance to authority; negativism, 3) hypochondriasis, 4) irritability, restlessness, 5) lability, 6) suppression of emotions, 7) low tolerance level, 8) impulsivity, 9) conformity, and 10) inhibition.

The judgments of judge 2 showed significant differences between the groups (Exact "P" value = .029) for "lability" with the seen group being more labile than the unseen group.

Judge 1 established significant differences between groups (Exact "P" value = .054) for "conformity" with the unseen group being more conforming.

The quantitative and clinical findings implied the importance of having a thorough knowledge of each individual and a program of guidance and psychotherapy or counseling for each patient.

### Conclusions

1. The two groups could not be considered to be differentiated by the following characteristics: 1) too high goals, 2) resistance to authority; negativism, 3) hypochondriasis, 4) irritability, restlessness, 5) suppression of emotions, 6) low tolerance level, 7) impulsivity, and 8) inhibition.

2. The two validly differentiating characteristics, namely lability and conformity, each were determined on the basis of a single judge's ratings. To be considered is the fact that each of these characteristics is one of two instances of significance at the 5 per cent level out of twenty comparisons, where one out of twenty (5 per cent) on the average can be expected to be significant due to chance alone. This calls the validity of these significant differences somewhat into question, leaving it as an hypothesis worthy of further experimental testing.

3. No separate and distinct personality patterns could be established for the seen and unseen groups.

Microfilm copy of complete manuscript of 273 pages, \$3.41. Enlargements 6" x 8", 10¢ per page.

### THE ROLE OF SEXUAL IMPOTENCE IN THE CONCEPT OF SELF IN MALE PARAPLEGICS

(Publication No. 3606)

Stanley Berger, Ph.D.  
New York University, 1952

The present study is concerned with examining the role sexual impotence plays in the concept of self among paraplegic males. The basic elements and more peripheral configurations in the personality structure of each of thirty paraplegic patients was determined. In addition, the extent to which loss of sexual function is responsible for the differences in concept of physical, emotional, social and sexual self among the two groups of paraplegics studied was determined.

Earlier investigations of the psychological problems of paraplegic patients emphasized the medical and more superficial psychological aspects of the patient's functioning. After World War II the increase in the paraplegic population and the severity of this disability necessitated more intensive psychological study. Predominant and consistent findings indicate the presence of considerable depression, ambivalence concerning role in life and preoccupation with their own bodies and conditions in the paraplegic patients. Investigators dealing with sexual impotence in paraplegics expressed essentially two viewpoints: the ability to attain erection is in itself responsible for providing the patient with certain feelings of masculinity and psychological well-being; the loss of somesthetic stimuli from the genital organs is primarily responsible for the absence of sexual excitation.

The subjects of this study were a group of thirty paraplegic patients at the Institute of Physical Medicine and Rehabilitation, New York University-Belle-

vue Medical Center. Fifteen of these patients were sexually impotent, the other fifteen were sexually potent. The age range was from 18 to 45. Seventeen of the patients were married. The mean educational grade completed was 10.15 with a range from second grade completion to college graduation. No patient was included in this investigation whose duration of illness was of less than one year. The techniques employed in this study consisted of administration of the Rorschach Test, Thematic Apperception Test, Sentence Completion Test, and the Draw-a-Person Test. An initial interview was carried out with each patient. The findings on these tests were presented to four experienced clinical psychologists who served as judges, each deciding on the basis of the criteria established in this study, whether the five case records presented to him were impotent or potent.

The material gathered in this study was treated both quantitatively and qualitatively. The objective findings for the impotent and potent groups were statistically treated by application of the "t" test to determine significance of differences. In addition, the projective techniques were qualitatively analyzed and a personality description of each patient was made. The clinical judges, using the criteria established by the above procedures, were able to classify correctly eighteen of a total of twenty cases presented.

The findings of this study indicate that both the impotent and potent groups of paraplegic patients have decided psychological problems and difficulties. The impotent patients have, superimposed upon the difficulties inherent in a paraplegia, the problem of loss of sexual function. The impotent patients' concept of physical self includes marked feelings of body degeneration and distortion. The impotent patients' concept of sexual self includes preoccupation with their own genitalia which many of them regard as a mutilated or castrated organ. The impotent patient's concept of emotional self includes strong feelings of depression and anxiety, little drive or vitality, and preoccupation with his own highly personalized problems. The impotent patient's concept of social self includes marked difficulty in establishing warm and satisfying interpersonal relationships, and the manifestation of considerable feelings of hostility and aggression. It is recommended that future studies be directed toward an understanding of the role of sexual impotence in patients suffering disabilities other than in paraplegia, and in those cases where the impotence is on a psychogenic basis alone.

Microfilm copy of complete manuscript of 181 pages, \$2.26. Enlargements 6" x 8", 10¢ per page.

### MANAGEMENT OF ANXIETY IN ANXIETY NEUROSIS AND PARANOID SCHIZOPHRENIA

(Publication No. 3607)

Murray Blacker, Ph.D.  
New York University, 1952

The problem was to investigate the reactions of a group of anxiety neurotics and a group of paranoid



schizophrenics to culturally tabooed heteroerotic and homoerotic stimuli for the purpose of testing two aspects of Freudian psychoanalytic theory. These were: (1) That projection is used by the paranoid schizophrenic as a defense against repressed homosexual desires. (2) That the most important area of maladjustment in anxiety neurosis is to be found in current heterosexual activity.

Experimental studies appear to verify clinical observation of a relationship between paranoia and homosexuality, but it is not known if this relationship is mediated by the projection mechanism. The nature of the relationship between anxiety neurosis and sexual inhibitions has not been approached experimentally to date.

Thirty-four subjects, seventeen anxiety neurotics equated with seventeen paranoid schizophrenics, were tested individually with eight selected cards of the T.A.T. Immediately after, each subject was retested with the same cards verbally structured with erotic situations. The standard and structured stories were compared by three experts as to the extent of anxiety and projection. The inter-rater correlations, by the product-moment method, averaged .67 for projection and .48 for anxiety.

The significance of the differences in the extent of anxiety and projection in each of the stimulus situations - standard, homoerotic and heteroerotic - was determined by Student's "t" test.

For the anxiety neurotic group it was found that:

(a) There was a significantly greater extent of anxiety in the erotically structured stories than in the standard.

(b) There was a significantly greater extent of anxiety than projection in the erotically structured stories.

(c) There was a significantly greater extent of anxiety in the heteroerotic stories than in the heteroerotic stories of the paranoids.

(d) There was no significant difference between the extent of anxiety in the homoerotic and heteroerotic stories.

The results for the paranoid schizophrenic group were:

(a) There was significantly more projection in the structured stories than in the standard.

(b) There was significantly more projection than anxiety in the structured stories.

(c) There was significantly more projection in the homoerotic than in the heteroerotic stories.

(d) There was significantly more projection in the homoerotic stories than in the case of the anxiety neurotics.

(e) There was significantly more anxiety in the homoerotic stories than in the standard.

Both groups showed an arousal pattern to the culturally tabooed sexual stimuli indicating that the material might touch on deep-seated repressions with an arousal of anxiety and defenses against anxiety. Since the amount of anxiety in the heteroerotic and homoerotic stories of the anxiety neurotic group did not differ significantly, Freud's claim in regard to the difficulties in heterosexual activities of this group was not upheld. As for the paranoid

schizophrenic group, the significantly greater use of projection in reaction to the homosexual stimuli compared to the heterosexual gives support to Freud's claim that paranoids use projection as a defense against a repressed homosexual wish.

In terms of this experiment, the anxiety neurotics seems to be striving for a realistic solution of their emotional problems, but they have difficulty channelizing enough of their anxiety through the use of defense mechanisms. The paranoid schizophrenics appear to have placed most of their reliance on the projection mechanism to which they compulsively adhere even though their anxieties are not allayed.

The experiment gives additional evidence that psychoanalytic theory can be approached experimentally. The technique used appears to be an effective way, through the indirect application of the most explosive type of stimuli, of obtaining a clearer understanding of basic character defenses. It may be worthy, therefore, of further refinement as a research tool.

Microfilm copy of complete manuscript of 148 pages, \$1.85. Enlargements 6" x 8", 10¢ per page.

#### THE USE OF THE MINNESOTA TEACHER ATTITUDE INVENTORY IN APPRAISING COUNSELOR ATTITUDES

(Publication No. 3836)

Mabel Kunce Gibby, Ed.D.  
University of Missouri, 1952

##### Purpose

To determine how adequately the Minnesota Teacher Attitude Inventory, an instrument validated for the measurement of teacher attitudes, would differentiate individuals with respect to rated counselor attitudes.

##### Methods of procedure

Two judges independently rated counselor trainees and counselors on a Counselor Attitude Rating Scale. Rating discrepancies were discussed and a composite decision reached. Each rated individual was then assigned a value on a continuous scale. This final scaled attitude score was the criterion measure used to determine the extent to which Minnesota Teacher Attitude Inventory scores obtained by a prepublication key and two new keys developed in the present study differentiated individuals on the basis of their rated counselor attitudes.

##### Summary

(1) A "student group" was formed consisting of counselor trainees who were graduate education students at the University of Missouri majoring in the area of "guidance and counseling." These students had been administered a test battery including the Minnesota Teacher Attitude Inventory. Answer sheets were thus available for analysis.

(2) A "counselor group" was formed consisting of

individuals who were working in Missouri public high schools with full- or part-time guidance responsibilities for high school counseling programs. All of them completed the Minnesota Teacher Attitude Inventory and an information sheet.

(3) Data from the Counselor Information Sheets showed that upper and lower sub-groups of the counselor group, which was divided on the basis of rated counselor attitudes, were relatively homogeneous with respect to various personal, experiential, and educational factors.

(4) A highly reliable method of rating counselor attitudes was obtained by using competent judges who agreed on the meaning of a rating scale and who knew the individuals they were rating. The judges' independent ratings correlated .829 for the student group and .779 for the counselor group. The reliabilities of the composite ratings were .964 and .923 for the student and counselor groups, respectively.

(5) Final scaled composite ratings of counselor attitudes correlated .311 with Minnesota Teacher Attitude Inventory scores for the student group and .242 for the counselor group.

(6) Through use of item analysis techniques with phi coefficient to determine the discrimination of each item, responses to Minnesota Teacher Attitude Inventory items were analyzed to discover items which differentiated counselor trainees and counselors on the basis of final scaled composite ratings of their counselor attitudes.

(7) Thirty-eight items from the Minnesota Teacher Attitude Inventory were significant at the 5 per cent level of confidence in differentiating counselor trainees on the basis of their rated attitudes. Scores obtained by this key for counselor trainees correlated .537 with the final scaled criterion ratings. Scores for counselors obtained by this key correlated only .143 with final scaled attitude ratings. Validity was not established for use of the new key.

(8) Thirty-one items from the Minnesota Teacher Attitude Inventory were significant at the 5 per cent level of confidence in differentiating counselors on the basis of their rated attitudes. Scores obtained by this key for counselors correlated .550 with the final scaled criterion ratings. Scores for counselor trainees obtained by this key correlated only .171 with final scaled criterion ratings. Validity was not established for use of the new key.

#### Recommendations

(1) That limited significance be placed on the Minnesota Teacher Attitude Inventory scores in predicting rated counselor attitudes of both counselor trainees and counselors.

(2) That continued caution be exercised in generalizing the use of the Inventory from measurement of teacher-pupil rapport to measurement of rapport established in other situations involving work with youth until validity data are established.

Microfilm copy of complete manuscript of 207 pages, \$2.59. Enlargements 6" x 8", 10¢ per page.

#### CURRICULUM CHANGES IN PUBLIC SECONDARY SCHOOLS OF MISSOURI, 1890-1950

(Publication No. 3838)

Calvin Edward Harbin, Ed.D.  
University of Missouri, 1952

#### Purpose

The purpose of this study is to describe the curricular changes which have occurred in a selected number of high schools of Missouri that have been in existence from 1890 to 1950, and insofar as possible, to compare these changes with the recommendations of certain national, regional, and state agencies, committees, and commissions.

#### Method of Research

The historical method of research was used in this study with both the University of Missouri and the State Department of Education making available pertinent records and historical documents relating to the selected high schools. The high schools selected for study were located in California, Carthage, Hannibal, Kansas City, Maryville, Mound City, St. Joseph, St. Louis, Salem, Savannah, Springfield, and Trenton.

#### Summary

(1) There appears to have been a shifting emphasis away from college preparation as such from 1890 to 1950 toward a more general education.

(2) Significant changes in the programs of the selected schools began to appear around the approximate dates of 1890, 1917, and 1940.

(3) The breadth of the public high school program has continued to expand since 1890 with minor fluctuations.

(4) The nature of the program has changed from the narrowly academic to include more and more of the fine and practical arts, vocational training, and physical education courses.

(5) There has been a tendency to move from the highly specialized subject matter courses to generalized subject matter courses.

(6) The administrative organization of the program over the sixty years has moved from a required single curriculum in some cases to multiple curricula and back again to a single curriculum with a nucleus of required courses and a periphery of electives.

(7) The basic courses in English, mathematics, and science have been relatively constant possibly because of the influence of the colleges.

(8) Whatever changes have come have usually been effected after the suggestions and recommendations have issued from state and national agencies.

(9) The University of Missouri exercised from 1890 to 1910 direct influence in shaping the high school programs of selected schools.

(10) There is evidence to show that the National Education Association, through its committees and commissions, was influential in shaping the high school programs during this period.

(11) The chief state school officers in Missouri have been responsible for shaping the high school



programs to some extent through regulations, recommendations, inspections, classifications, and public relations activities.

(12) There is some evidence that the chief state school officers employed the delegated authority to classify and accredit as a means of control over the basic offerings of public high schools of Missouri.

(13) It would seem that the General Assembly has directly influenced the high school course offerings of the selected schools very little, as in most cases, the courses prescribed by law had been offered before the legislative mandates.

(14) The federal government has greatly influenced the vocational training and practical arts courses in the selected high schools by sharing the financial burden connected therewith.

(15) Direct influence on the high school programs of the selected schools by the Missouri State Teachers Association and the North Central Association of Colleges and Secondary Schools, since 1920, seems doubtful.

(16) The University of Missouri's undertaking of the inspection and accreditation of junior colleges in recent years seems to parallel uniquely its pioneering services of inspection and accreditation of Missouri high schools in the years following 1890.

(17) The 1893 report of the Committee of Ten of the National Education Association does not appear to have been revolutionary.

#### Recommendations

(1) Specific changes in course content should be explored for the same period of time as covered in this study for the purpose of completing the story of curricular change in the selected schools.

(2) A continuing collection of textbooks used in Missouri public high schools, past, present, and future, should be made and added to the Curriculum Laboratory of the University of Missouri for use of teachers-in-training.

(3) Each high school administrator in Missouri should begin immediately to gather for the permanent records of his school the pertinent data on past and present programs for his own use, and for the use of his successors, and curriculum planners.

(4) The official records of public high school programs should be modified to conform to the current organizational patterns of the enlarged secondary school programs, and provisions should be made in report forms for reporting different and unusual courses, recent and unique changes in programs such as the core curriculum, courses in general education, orientation, and other valuable innovations.

Microfilm copy of complete manuscript of 456 pages, \$5.70. Enlargements 6" x 8", 10¢ per page.

#### TYPES AND FREQUENCY OF SENIOR HIGH SCHOOL GUIDANCE PROBLEMS: THEIR IMPLICATIONS FOR THE TRAINING OF COUNSELORS

(Publication No. 3618)

Donald Sellers Klopp, Ed.D.  
New York University, 1952

The purpose of this investigation is to provide a basis for the pre-service and in-service training of counselors for suburban high schools through the study of guidance problems as they are revealed in individual interviews with senior high school pupils. On the subject of counselor training there is a wide divergence of opinion among state authorities, college training centers, recognized writers, professional organizations, and practicing counselors. The bulk of research on the topic seems related to guidance problems as seen on the college level.

The investigator gathered his data through records kept of all counseling interviews held by him in the Clifford J. Scott High School, East Orange, New Jersey, during two school terms, 1947 to 1949. His counseling responsibility was of a non-punitive nature, and his philosophical orientation eclectic. Of the 598 clients contributing 2206 interviews, 470 juniors and seniors accounted for the 1903 which provided the prime data of the study.

The system of experimental categories was derived from both normative studies of the literature and empirical observation. The ten chosen categories, together with their percentages of problem incidence for juniors and seniors, were as follows: School Failure (24.5%), Vocational Placement (21.4%), College Entrance (20.6%), Adjustment to School Work Other Than Failure (10.2%), Home and Family (7.3%), Sex and Personal-Psychological Relations (6.6%), Social-Recreational Problems (3.3%), Military Service (2.8%), Health (2.6%), and Other Problems (.7%).

Tests of reliability made from a random sampling of one-tenth of all the data produced the following results: reliability of interpretation after a one-month interval,  $r = .99$ ; split-half analysis,  $r = .95$ ; and odds-even comparison,  $r = .99$ . A more objective measure, free of internal compensatory factors, — an interview-by-interview re-analysis — revealed that the experimenter was able to reclassify 90% (S. E. 1.57%) of the problems "correctly."

An evaluation of a random sampling of fifty recorded interviews, from which typescripts were prepared for three outside judges, counselors adjudged professionally competent, measured the validity of the investigator's diagnosis. The judges worked independently, using 367-page manuscripts. All four readers (counting the investigator) used an average of 2.76 of the experimental categories per interview, the criterion panel alone averaging 2.47. Of all diagnoses 86% were agreed upon by at least one pair of judges. Highest agreements were for college, vocational, failure, and adjustment problems. The categories with the greatest inter-associational tendencies were failure, adjustment, college, and home.

Further analyses of the readers' perfect agreements, disagreements, average agreements, and significant differences in proportions pointed to the practicality of the category system and to the validity of the experimenter's use thereof. The results indicated that he agreed better with the criterion panel, as a group, than they did among themselves collectively.

An examination of the distribution of 3226 problems showed the following correlations, together with their critical ratios: by grade-- $r.68$  (2.22); sex-- $r.88$  (3.65); curricula-- $r.72$  (2.58); year of origin-- $r.98$  (6.). The significant differences, category by category, were also found.

New proposals for differential counseling and training were made for the various status groups mentioned, as well as for all supplementary groups counseled—grades nine-ten; graduates; drop-outs. The investigator recommended that training elections be made from a total of 55 relevant subjects or courses (with an accent on the dynamics of interpersonal relations), these grouped to "match" the nine major problem categories. Proportions of training elections to meet the problem incidence revealed, respectively, by each status group, as well as for all 598 clients, were specified. For counseling these particular upper classmen, a cadet's training might well observe the following proportions:

To meet the Failure Problem (1/4); Vocational Problems (1/5); College-Entrance (1/5); Adjustment (1/10); Home (1/14); Sex-Personal (1/16); Social-Recreational (1/33); Military Service (1/36); Health (1/38).

Microfilm copy of complete manuscript of 197 pages, \$2.46. Enlargements 6" x 8", 10¢ per page.

#### THE EFFECT OF FAILURE IN SIMILAR AND DISSIMILAR TASKS ON THE CONTINUATION OF A PROBLEM SOLVING SET

(Publication No. 3676)

Cynthia Lewin, Ph.D.  
New York University, 1951

##### The Problem

The purpose of this investigation was to study the effects of failure in similar and dissimilar tasks interpolated in a series of problems on the continuation of a problem-solving set.

The main problems of this thesis were: (1) to study the effect of failure in insolvable tasks interpolated in a series of problems on the continuation of a problem-solving set; (2) to study the effect of the interpolation of tasks similar to the original material and dissimilar to the original material on the continuation of a problem-solving set; and (3) to study the effect of failure and non-failure in similar and dissimilar material on the continuation of a problem-solving set.

Luchins<sup>1,2</sup> reports that various types of interpo-

lated material disrupt a problem-solving set. Christie<sup>3</sup> reports that frustration (i.e., failure) increases the strength of a set. The respective hypotheses were tested.

##### Procedure

The responses of 80 subjects to a series of jar problems, hidden-word problems and potato problems<sup>4</sup> were utilized. Four groups were delineated in terms of the type of material interpolated: F. S. (fail-similar), F. D. (fail-dissimilar), N. F. S. (non-fail-similar), and N. F. D. (non-fail-dissimilar). Failure was induced by introducing problems which could not be solved. Both fail groups were told they were taking an intelligence test. Both non-fail groups were told they were just part of an experiment.

The series of problems consisted of: (a) four problems which could be solved by the same method; (b) two problems which could be solved by the same or a more direct method; (Solution of these two problems by the repeated method was the criterion for the establishment of a problem-solving set.) (c) the respective interpolated problems; (d) two problems which could be solved by the repeated method or a more direct method, and (e) one problem which could be solved only by the direct method.

Each subject was tested individually. Comments and time taken for solution were recorded. All subjects were of average I. Q. drawn from the 6th, 7th and 8th grades of New York City public schools.

##### Results and Conclusion

The measure of the continuation of a problem-solving set was the solution of the two problems subsequent to the interpolated material by the previously repeated method, and the failure to solve the last problem which could be solved only by the direct method.

The results in terms of the three problems stated were:

(1) In the failure group, viz., F. S. and F. D., 45 per cent of the subjects showed a continuation of the problem-solving set as defined here. In the non-failure group, this pattern was noted in 70 per cent of the subjects. The significance of the differences between the group percentages was computed. A critical ratio of 2.27 was obtained which is significant at the 5% level of confidence.

(2) In the F. S. and N. F. S. groups 53 per cent of the subjects continued the problem-solving set. In the F. D. and N. F. D. groups combined 63 per cent of the subjects continued the set. The critical ratio of the difference is .99 which is not significant.

(3) In the F. S. group 35 per cent of the subjects continued the set. In the N. F. D. group 70 per cent of the subjects continued. The difference is significant at the 1% level of significance.

In the F. D. group 55 per cent of the subjects continued the set, and in the N. F. S. group 70 per cent continued. The critical ratio was 1.23 which is not significant.

In all groups there was a significant decrease, at



the 1% level of confidence, in the usage of the repeated method after the interpolated material.

Under the conditions of this experiment, Luchins' hypothesis was substantiated whereas Christie's was not.

<sup>1</sup> A. S. Luchins, *The Effect of Einstellung on Learning*. Doctoral dissertation. New York University, 1939.

<sup>2</sup> \_\_\_\_\_, "Mechanization in Problem Solving," *Psychological Monographs*, 54 (1942), 95 pp.

<sup>3</sup> J. R. Christie, *The Effects of Frustration Upon Rigidity in Problem Solution*. Doctoral dissertation. University of California, 1949.

<sup>4</sup> See the thesis for the exact series of problems used.

Microfilm copy of complete manuscript of 92 pages, \$1.15. Enlargements 6" x 8", 10¢ per page.

# A STUDY OF THE TRANSFER EFFECTS OF SYNTHETIC FLIGHT TRAINING IN NAVAL AIR ADVANCED TRAINING

(Publication No. 3687)

Walter Robert Mahler, Ph.D.  
Columbia University, 1951

## Purpose

The principal objective of this research was to study the extent of transfer from practice on synthetic flight trainers to the task of learning to fly a multi-engine aircraft. Trainer design implications and effective utilization techniques were secondary problems.

## Situation

Advanced Naval Air Training Command, Corpus Christi, Texas; Aviation Training Unit 10, PBM two-engine seaplane training, and Unit 12, PB4Y four-engine landplane training.

## Students

Ninety-six graduates of Basic Training, divided equally between the two Training Units.

## Experimental Design

The successive-practice method, in which the transfer group learns A, then learns B, and the control group learns B. Pairs were matched on Basic check flight grades to secure equivalent groups.

## Procedure

Synthetic training - Students in the transfer group received eleven three-hour periods of standardized synthetic training.

Flight training - Each pair of students flew the regular familiarization (FAM) and instrument (INST) syllabus.

Measurement of transfer effect - An objective-type system of grading performance was developed to measure trials and errors.

## Results

**Trials and time** - A positive difference of one to two trials on almost all maneuvers demonstrates that transfer does occur from practice on synthetic flight trainers to the task of learning to fly a multi-engine aircraft. However, when translated into possible time saving, practice on synthetic trainers can replace only a small portion of the current flight syllabus.

**Errors** - The total number of errors can be considered a good indication of the quality of a student's flight performance. In FAM stage, experimental students, on the average, made fewer total errors than control students on procedural maneuvers. On the two most crucial maneuvers, Take-Off and Landing, the differences were negligible. In the case of seaplanes, negative differences suggest the possibility that OFT training might actually interfere with later learning.

Experimental students, on the average, made fewer errors on all maneuvers in INST stage.

The hypothesis that synthetic training is primarily of value on procedural tasks is verified by the evidence. However, not all such tasks benefit equally. In a few instances indications of negative transfer occur. Considerable transfer was inferred in the area of attitudes, i.e., confidence and lack of tenseness.

**Utilization** - The existence of negative attitudes on the part of some of the instructors was noted during the course of this study. Suggestions for overcoming such difficulties were made. In general, the instructors and students seem to favor the policy of one flight in the trainer preceding a plane flight in which new material was to be learned. It seems logical to emphasize those maneuvers upon which the greatest transfer occurs.

**Trainer Design** - Only a few of the possible hypotheses were considered.

The more similar the essential patterns of the total learning situation in the training device are to those of an aircraft, the greater the transfer. The evidence reported in this study supports this expectation.

A reversal of relationships between stimulus and response which are to be learned results in negative transfer. Three instances occurred during the course of this study which seem to suggest that this principle applies to certain aspects of synthetic training.

The more difficult discriminations are the ones upon which greater possible transfer is likely to occur. The data fail to reveal any consistent relationships between difficulties measured through proportion of errors and amount of transfer.

As the degree of learning is increased, the tendency toward negative transference is increased. The low positive transfer reported in this study could be due, at least in part, to the fact that the degree of learning expected at this stage is low.

Microfilm copy of complete manuscript of 155 pages, \$1.94. Enlargements 6" x 8", 10¢ per page.

**AN INVESTIGATION OF THE PERSONALITY  
FACTORS OF DEPENDENCY AND  
OVERCOMPENSATORY GOAL STRIVING  
BEHAVIOR ASSOCIATED WITH THE  
DEVELOPMENT OF PEPTIC ULCER IN  
A GROUP OF VETERAN MALE PATIENTS**

(Publication No. 3625)

Irving Raifman, Ph.D.  
New York University, 1952

An outstanding personality theory regarding the peptic ulcer personality, that which was proposed by Franz Alexander and others, was tested in this study. Those writers described the ulcer personality in numerous articles as having a conflict over unacceptable dependency wishes. They have discussed this conflict as one in which the ulcer patient fights internally against the expression of these wishes, denying these needs on the surface by presenting a facade of overcompensatory goal striving activity. Thus, the peptic ulcer patient is characterized as a "go-getter", as an assertive, active, independent person who is concerned with activities which demonstrate his self reliance and aspirations.

**The Research**

Forty-five white male veteran patients between the ages of 22 through 45 were studied by analyzing the data obtained from three psychological tests of projection; the Rotter Level of Aspiration, the Rorschach, and the Thematic Apperception Tests. The data collected were treated in two ways; by a qualitative analysis which involved the use of two judges who rated four questions relating to the hypotheses after analyzing the three psychological tests, and by a quantitative analysis which involved a statistical analysis of the devices used in the research.

There were three groups of patients; fifteen diagnosed as peptic ulcer, fifteen diagnosed as psychoneurotic, and a like number of patients with minor surgical problems who were selected as normal on the basis of their performance on the Cornell Selectee Index. The diagnoses were established by the ward physicians in charge of the cases, using the complete medical facilities available at the Kingsbridge Veterans Administration Hospital, Bronx, New York. The first fifteen patients for each of the three groups who met with the criteria of the study were tested.

The patients were found similar with respect to age and education. Comparisons were made as to their occupational status, religious denominations, and marital status and the groups were not dissimilar with respect to these.

The study was stimulated by the plethora of psychiatric, psychological, and neurological studies that deal with the problem of peptic ulcer, by the repeated failure of the physicians to control the illness by a strictly medical regime, by the assumptions made by Alexander and others which have been publicized although few experimental studies have been undertaken to test the assumptions, and by the

conclusions of some investigators that see a close kinship existing between ulcer patients and psychoneurotic patients.

The first two hypotheses tested were based on the implications of the Alexander hypothesis; the third hypothesis was based directly on the assumptions made by Alexander and others. They were, namely, that

1. Veteran peptic ulcer patients express significantly more dependency needs than normal and psychoneurotic patients.

2. The dependency needs of peptic ulcer patients are significantly less acceptable to their personalities than the dependency needs of normal and psychoneurotic patients.

3. Veteran peptic ulcer patients substitute a facade of overcompensatory goal striving activity to mask their feelings of dependency whereas the control groups do not show this defensive mechanism.

**Conclusions**

The first two hypotheses were not supported by the findings. Dependency needs are manifested markedly by the majority of veteran patients used in this study. Dependency needs are largely non-acceptable to the personalities of most patients used in this study.

The findings did, however, support Alexander's assumptions as stated in the third hypothesis. Ulcer patients react to their non-acceptable dependency needs by overcompensating through goal striving activity whereas the control groups do not employ this reaction.

The findings further indicate from the preceding statement that the dynamics underlying the ulcer personality are different from those which underly the psychoneurotic personality.

Microfilm copy of complete manuscript of 181 pages, \$2.26. Enlargements 6" x 8", 10¢ per page.

**AN EXPERIMENT IN REDUCING THE  
INFORMATIONAL DIMENSION OF PREJUDICE**

(Publication No. 3920)

Zachariah Subarsky, Ph.D.  
Columbia University, 1952

**The Nature and Objectives  
of the Study**

With the growth of the United Nations and the rise of the United States to a position of leadership among the free nations of the world, intercultural and interracial relations take on a new significance not only for American statesmen but for American citizens generally.

Group conflict, frequently motivated by political, social, or economic factors, is augmented by misconceptions transmitted culturally from one generation to the next. The correction of such misconceptions through education is an important step in the alleviation of group conflict.

It was perhaps natural that social studies teach-



should have taken the lead in providing intercultural and interracial education. More sporadically, biology teachers have directed some of their teaching to this end. It seemed desirable (1) to know how Biology and Social Studies might function together to reduce the informational dimension of prejudice, and (2) to measure the effectiveness of such an integration by comparing students who have been exposed to the integrated teaching with comparable students who have been exposed to the conventional courses in Biology and Social Studies.

#### Development and Experimentation

A school year was devoted to making a close study of the objectives, content, and methodology of the two existing courses in high school biology and Social Studies. Another school year was devoted to orienting the teachers and to studying existing evaluation instruments. None of the existing instruments were found to be quite suitable for the experimentation at hand. Therefore a special test was constructed.

A third year was devoted to preliminary experimentation. Experimental classes were set up at the Bronx High School of Sciences to take the integrated courses. These classes were compared with control classes at the Bronx High School of Science who took the conventional course in biology and Social Studies.

A fourth year was devoted to expanded experimentation. During this year the number of experimental classes was increased. Control classes were set up also at a comparable high school - Stuyvesant High School in Manhattan. Two additional tests were especially constructed. The three tests were used in comparing the experimental group at the High School of Science with control groups at the High School of Science and with control groups at Stuyvesant High School.

#### Findings and Conclusions

Though not uniformly consistent, the overall picture of the analysis of the data obtained with all the tests over the entire experimental period gives a strong indication of the greater effectiveness of the experimental situation over the control situation in liberalizing the views of the pupils involved in this study.

The subjects of this experimentation were children above the average in intelligence, academic achievement, and interest in science. It is not to be assumed that the integrated courses that were developed and the methods of teaching that were employed would be effective with children below average, or even average intelligence and academic achievement. But even with such children, it is conceivable that effective results might be achieved through the use of modified teaching materials and appropriately modified teaching procedures built around the general scheme of integration developed in this study.

Microfilm copy of complete manuscript of 112 pages, \$1.40. Enlargements 6" x 8", 10¢ per page.

#### THE RELATIONSHIP OF PERSONALITY CHARACTERISTICS TO MEASURED INTERESTS OF WOMEN TEACHERS OF ENGLISH, SOCIAL SCIENCE, MATHEMATICS, AND PHYSICAL SCIENCE IN CERTAIN SENIOR HIGH SCHOOLS

(Publication No. 3627)

Francis Joseph Tometry, Ph.D.  
New York University, 1952

The study investigates whether there are (1) characteristic personality traits in high school women teachers of English, Social Science, Mathematics and Physical Science and in those vocationally interested in these subjects (2) characteristic differences among the groups (3) differences from the general population and (4) relationships between the measured vocational interests and measured personality traits of these groups.

The tests used are the Strong Vocational Interest Blank for Women (Revised), Guilford-Martin Personality Inventories, GAMIN, STDCR, and Personnel; Johnson Temperament Analysis; and Allport-Vernon Study of Values.

Teachers selected were college graduates, with at least five years experience in teaching the subjects and employed at least three years in the school district. They were secured by personal contact and by mail. Since the nature of the tests permitted it, they were self administered.

There were 194 teachers: 83 English, 60 Mathematics and Science, and 51 Social Science. They were drawn from 47 school systems in 20 states. The largest number came from New Jersey but all sections of the United States were represented.

The groups are compared in age, experience, and education among themselves and with the Strong groups by chi square and critical ratio. Critical ratios for the 28 personality traits are found between the groups and the norm populations, between the groups themselves, between the interested and not interested classes of each group and finally between the interested classes.

Biserial, linear, and curvilinear correlations between scores on the Strong Blank and personality tests are computed and chi square test of non-linearity applied. Multiple correlations for significant linear correlations are found.

Critical ratios and correlation coefficients are tested for significance at the five and one per cent levels.

#### Conclusions

The groups are mature, experienced and advanced in education, with the interested class higher in each. They are generally alike and show emotional stability, femininity, physical and social passiveness, cordiality, sympathy and good occupational morale. In values, they are "feminine," with differences based on subject matter interest.

When compared among themselves, the Teacher of English is more emotional, subjective, and aesthetic; Teacher of Mathematics and Science, more controlled, quiet, reserved and theoretical; Teacher

of Social Science, more socially extraverted, warm and understanding.

The interested classes do less well on desirable traits than the not interested.

Biserial and linear correlations duplicate each other and confirm the results by critical ratio.

All multiple correlations are significant. The coefficients and most effective tests are:

Social Science Teacher ( $r=.628$ ). Thinking introversion, religious value, sympathy, low political value.

English Teacher ( $r=.585$ ). Depression, aesthetic value, low economic value, low cordiality.

Mathematics-Science Teacher ( $r=.516$ ). Social passiveness, self mystery, low sympathy.

The groups are distinctly differentiated from the norm populations and further differentiated among themselves but to a lesser degree. Teachers of verbal subjects show less differentiation from each other than from teachers of quantitative subjects.

Teachers vocationally interested have measured traits which differentiate them from those not interested. Teachers of verbal subjects show much greater differentiation between these classes than teachers of quantitative subjects do.

Significant relationships between the Strong Blank and personality traits exist but the coefficients rarely exceed .40.

Previous studies using personality tests for teachers and student teachers are generally substantiated.

Darley's description of masculinity-femininity and the social qualities of the group expected by his hypotheses are partially substantiated.

Strong's view that teachers interests are based on subject matter is paralleled by the differentiation of the groups in personality traits.

The results suggest a process of interaction between vocational interests and personality characteristics with both as expressions of the total personality of the individual.

Microfilm copy of complete manuscript of 234 pages, \$2.93. Enlargements 6" x 8", 10¢ per page.

#### A NORMATIVE STUDY IN PREADOLESCENT FINGER-PAINTING PROJECTION

(Publication No. 3628)

Carlotta Sommers Trussell, Ph.D.  
New York University, 1952

The central problem of the research was to secure normative data in finger painting by preadolescent children, and to suggest some of the psychological meaning of paintings and concomitant behavior.

Procedures in collecting and treating data were as follows. A homogeneous group of 67 normal preadolescent subjects worked, two at a time, with standardized finger-painting materials, for one-hour periods. A screen, separating the two children, provided for individual observation by the examiner, who recorded notes on their behavior.

Using 268 paintings, four from each subject, the investigator later analyzed paintings and the concomitant behavior as recorded during the tests. Paintings *per se* were classified in terms of color, amount of space utilized on the painting page, line and form, patterns, and subject matters. Demeanor of the subjects was categorized in terms of amount of paint employed, first paint placement, tempo, pressure, use of hand and arm, motion, amount of verbalization, contacts with painting partner and with examiner, and reactions after painting.

Tentative interpretations of painting elements and behavior were made by intensive study of paintings and records, together with reference to findings of previous workers and careful rationale. Case histories which were introduced into the dissertation also were supportive of the tentative interpretations.

Evidence that norms were attained inheres in the quantitative data which tend to cluster since normal subjects are more similar than dissimilar; and which show group distribution regarding each aspect of finger-painting behavior.

Findings were that the subjects evinced certain preferences or displayed certain behavior in the following sequences:

Color: blue, red, green, brown, black, yellow.

Warm or cold colors: both; cold only, warm only.

Colors per painting: one; two; three; four; five; six.

Arrangements: overlay; overlapping; multi-color; muddy effects; separate but touching; non-contiguous color.

Overlay: cold over warm; warm over cold; yellow over blue; heavy red; light blue-green over yellow; green over yellow.

Emphasis: line and form; color emphasis.

First paint placement: one daub centrally; one daub peripherally; more than one daub systematically; more than one daub unsystematically.

Amount of paint: medium; large; small.

Tempo: Medium; fast; slow.

Pressure: medium; heavy; light.

Parts of hand employed: one finger; whole hand flat; finger tips; clenched fist; flat part of fingers; base of palm; palm flat, fingers raised; side of hand; knuckles; finger nails; side of thumb.

Motion: smooth; stipple; smear; pat; slap.

Area: almost fills page; fills page; fills and runs off; fills one-half page; fills one-third; fills one-fourth.

Character of line: continuous; short; scattered; short with weak finish.

Axis: diagonal; horizontal; vertical.

Stroke direction: away; toward; back and forth.

Patterns: circle; straight line; scallop; wiggle; vibration.

Productions: alternate circles and verticles; squares; triangles; endless circles; crosses.

Type of painting: non-objective; pictorial.

Content: skies and sky-lines; rain or storm; humans; dark clouds.

Contacts with painting partner: friendly; imitates; attacks; criticizes.

Contacts with examiner: friendly; dependent; seeks attention; appears rebellious; attacks; appears disinterested.



Reactions after painting: no obvious pleasure nor displeasure; pleased; displeased.

The normative data may serve as an approximate means of comparison by which clinical workers can estimate finger-painting behavior and productions of other preadolescent children. The suggested psychologic meanings may lead to increased precision in interpretation.

Source materials included literature on personality dynamics, projective theory, related projective methods and finger-painting *per se*. Especially useful were investigations of Ruth Shaw, first to suggest finger-painting as projection; Peter Napoli, who produced a doctorate research on the topic at the School of Education, New York University; Werner Wolff, who developed some interpretations of children's finger paintings; Rose Alschuler and La Berta Hattwick, who made a detailed and systematic study of children's brush paintings.

Microfilm copy of complete manuscript of 168 pages, \$2.10. Enlargements 6" x 8", 10¢ per page.

## HISTORY

### THE ROLE OF THE CIVIL ENGINEER IN INTERNAL IMPROVEMENTS: THE CONTRIBUTIONS OF THE TWO LOAMMI BALDWINS, FATHER AND SON, 1776-1838

(Publication No. 3869)

Frederick Kendall Abbott, Ph.D.  
Columbia University, 1952

The dissertation examines the role of the civil engineer and the development of the engineering profession in connection with the program of internal improvements in the United States from 1776 to 1838 as it was understood by two early American civil engineers, the two Loammi Baldwins, father and son.

The Baldwins as engineers saw the work of the engineer as an integral part of the internal improvements program, fundamental to it because the success of the program depended upon the knowledge and skill of the engineer. Yet the profession of civil engineering was as new and experimental in America in 1800 as was internal improvements and it may be said that it came of age with that program. For the Baldwins the success of the program was dependent upon the discovery and application of sound scientific principles in engineering, and they saw in the combination of a national program of internal improvements and the establishment of a scientific profession of civil engineering the key to the development of the economic prosperity of the new American nation.

The dissertation is divided into two parts. The first part deals with the contributions of the elder Baldwin whose career paralleled the first years of American independence. In his day engineering as

a science did not exist. He was self-educated and his work was highly experimental, while the internal improvement projects with which he was associated were local in character and suffered from a lack of technical know-how and a shortage of capital. His great achievement was the Middlesex Canal, the best example of the pioneer stage of internal improvements. His work was important primarily for the stimulus which it provided for the later great contributions of the son.

The second part of the dissertation deals with the contributions of the younger Baldwin. The work of the younger Baldwin was in a very real sense a completion of the experimental beginnings made by the father and a beginning of civil engineering in America as a modern profession. His work in substantial part was associated with the enlarged concept of internal improvements as a national program which grew out of the recommendations of Gallatin's Report. Baldwin himself regarded internal improvements as a great national associated effort. He was convinced that its success lay in the program of Federal support inaugurated by John Quincy Adams. From the vantage point of this enlarged concept the younger Baldwin was able to take a more comprehensive view of the role of the engineer in the program and to draw a more complete connection between the development of the engineering profession and the promotion of the economic prosperity of the new American nation.

With the defeat of Adams and the end of Federal sponsorship of internal improvements, Baldwin felt the opportunity for establishing a sound national planned economy had been lost. For this failure he blamed the Jacksonians' emphasis on party rather than national interest.

While the work of the younger Baldwin was necessarily restricted by the limited scientific knowledge in his day, his recognition of the necessity of building the profession on sound scientific principles entitled him to the appellation, "Father of Civil Engineering in America," while his concept of the role of the engineer in the development of the economic prosperity of the new American nation, and the relationship which he established between the program of internal improvements, Federal aid and the development of the profession of civil engineering represents an important contribution to the contemporary thinking of the early national period of American History.

Microfilm copy of complete manuscript of 245 pages, \$3.06. Enlargements 6" x 8", 10¢ per page.

### JAMES GILLESPIE BIRNEY: EXPONENT OF POLITICAL ACTION AGAINST SLAVERY

(Publication No. 3746)

Betty Lorraine Fladeland, Ph.D.  
University of Michigan, 1952

Although James G. Birney was one of the outstanding figures in the antislavery movement in the United States, no complete study has been made previously of his role in that crusade except one by his son which was published in 1890. Since that time a large body of

Birney papers has been found which shed new light on the antislavery movement and on Birney's part in it.

In writing this biography I have relied primarily on the collections of Birney manuscripts. For the early period of his life research in state and local history in Kentucky and Alabama was necessary. Church records, county records, and college records yielded some information, and local newspapers a good deal more. In writing of the period after his antislavery work began, I have tried to fit the material from his own correspondence and writings with that of the antislavery movement as a whole as revealed in the papers of other men, the records of the societies, contemporary publications, and memoirs.

Birney was a Southerner and a slaveholder by birth, yet the origins of his antislavery opinions can be traced back to very early childhood, and there are evidences that antislavery influences were present at almost every stage of his education. Once convinced of his individual responsibility to work for some solution to the problem of slavery, he progressed gradually but steadily from slaveholder to abolitionist.

While still in Alabama, Birney gave up a lucrative practice, perhaps a brilliant future, in law to become an agent for the American Colonization Society. He was soon persuaded, however, of the ineffectiveness of colonization as a real solution, and by 1833 he despaired of any success in a movement against slavery in the lower South. Hoping that efforts in the border states might be effectual, he moved to Kentucky where he advocated a system of gradual emancipation, and finally immediate emancipation. Opposition prevented the establishment of an antislavery newspaper and convinced Birney that slavery not only deprived Negroes of rights, but also denied to white men the exercise of their own civil liberties. Further experience with mobs in Cincinnati convinced him that the repressive effects of slavery extended even to the free states.

The early phase of the antislavery movement was religious in character. Its aim was reform by moral suasion. Birney was one of the first to recognize that, because slavery was incompatible with republican government, it must be fought at the ballot box also. Acceptance of this idea led to the formation of the Liberty party. Birney was its candidate for the presidency in 1840 and again in 1844 when he received enough votes to deal a heavy blow to the Whig party, thus helping to pave the way for the break-up of that party and the consequent formation of the Free Soil and the Republican parties. Although an accident prevented Birney from taking an active part in the movement after 1845, his advice was still sought, and his writings for the cause continued until his death in 1857.

Microfilm copy of complete manuscript of 469 pages, \$5.86. Enlargements 6" x 8", 10¢ per page.

# THE PHILIPPINES, COMMONWEALTH TO REPUBLIC: AN EXPERIMENT IN APPLIED POLITICS -- PART I: THE ECONOMIC BASES

(Publication No. 3891)

Charles Orville Houston, Jr., Ph.D.  
Columbia University, 1952

The prosperity of the Philippines and its Government rested upon four export industries and one or two domestic industries. Forming the most important export commodities were sugar, coconut products, hemp and tobacco. Domestically, rice (associated with corn) and fish represented the core of the nation's economy, with rice, by all odds the most important.

At least 75 per cent of the population was directly dependent upon rice for their livelihood with the sum of one and a half billion pesos (or half of the total investment in all phases of farm investment in 1935) invested in the rice industry. The area planted to rice, in the years before the War, some 1,900,000 hectares, represented nearly half of the total hectareage planted to all other crops. The production, in the pre-War years, of some fifty million cavans (or one hundred million bushels) exceeded in value all other products, including sugar.

Production, however, failed to meet domestic requirements despite much planning, and, by 1941 after seven years of the Commonwealth program, the nation was forced to import two million bushels to meet requirements. The situation had changed little by the institution of the Republic, and the years after 1946 saw a continuing deficit, amounting in 1948, to some eight million cavans.

The major problems, with reference to the rice industry, at the opening of the Commonwealth, in 1934, were vast and centered around distribution and marketing, diversification, modernization of methods, control of the various factors attendant upon these, and the land system. Since the solution of the first four depended upon an early solution to the last, the problems of usury, tenancy, caciquism and tenure demanded prompt, efficient and early action. President Quezon, recognizing this, established as one of the main objectives of the Commonwealth, in general, and his administration, in particular, a program of "social justice" which, he said, would eliminate the manifold injustices of the past. Reserving for a later, more detailed, discussion this subject of the "social justice" campaign, the history of the Commonwealth reveals that, for all practical purposes, this campaign had, by the end of that period, proven a failure, and, indeed, had deepened in gravity the dangers to the stability of the nation.

The problems facing the four export items, as well as the other major domestic industries, were much the same as those of the rice industry. Aside from different details necessitated by the particular demands of each industry, the program of the Commonwealth was much the same for these other items as that established to solve the problems of the rice industry. The Government attempted to meet all these problems by creating such official bodies as the National Economic Council (charged with studying and



directing the economic program of the Commonwealth; the National Rice and Corn Corporation (charged with stabilizing the rice industry, largely through distribution); the National Abaca and Other Fibers Corporation (charged with a similar task, by similar methods, for the hemp industry); the National Coconut Corporation (whose program, again, was similar to the others); the National Tobacco Administration (a failure) and the National Tobacco Corporation (also a failure); various bodies charged with aiding the sugar industry which was the only one to remain prosperous during the period, and others charged with developing the fishing industry, the livestock industry, and maintaining public health and relief.

The results of these programs were much the same: a general failure to meet the problems, a general lack of understanding of what the problems actually were, and a general failure to establish efficient, well-organized, well-directed and well-appropriated programs to study and meet those problems about which understanding existed. The few exceptions provided by several entities within the Government itself rather than within any of the special bodies created, only brought into clear relief the failures of the latter.

Viewed from the aspect of the rice industry alone, the social and economic situation obtaining at the outbreak of the War, in 1941, had become so serious that the political stability of President Quezon's Government was rapidly being undermined. Whether the process of dissolution had proceeded to the point where the Government would have collapsed had there been no war, is a subject for speculation and, as such, need not enter our discussion. However, from an analysis of these same forces in the post-War period and during the early years of the Republic, in which period few changes occurred in the basic conditions of the nation, certain conclusions might emerge which would have value in aiding the direction of the policies of the Government for the future.

Microfilm copy of complete manuscript of 710 pages, \$8.88. Enlargements 6" x 8", 10¢ per page.

#### NATIONALISM IN ELEMENTARY SCHOOLBOOKS IN THE UNITED STATES FROM 1776 to 1865

(Publication No. 3906)

Ruth Virginia Miller, Ph.D.  
Columbia University, 1952

This study is an attempt to discover what patterns of social concepts were considered typically American in the first schoolbooks of the nation. These books were endeavoring to establish an American tradition; they were setting up standards of Americanism which could be used to define an American nationality.

The problem has been approached by the author in two ways: 1. What did the textbook writers choose

from past and current social thought as worthy of perpetuation in America? 2. In what ways was America differentiated from the rest of the world? These textbooks and the Bible made up the bulk of the formal literature encountered by most Americans in this period. Therefore the patterns that they establish should be a common denominator to American thought in the period as well as a clue to the foundations of American nationalism.

The investigation was based on an analysis of 808 books used in American elementary schools; these included arithmetics, American histories, geographies, readers and spellers.

In all, the sentiment of loyalty to nation was paramount to all other group loyalties. The child was taught that his nation was superior to other nations, and that the maintenance of this superiority required him to reject Europe and things European. Because the individual was assumed to inherit characteristics of both race and nationality, and because the characteristics assigned to other nationalities were unpleasant ones, the child would be conditioned to hostility toward foreign nations and to the immigrants from those nations. The adult of 1865 trained by these books would in no sense be prepared to accept the Negro as an equal. Individual personality was submerged in that of the nationality. Because of this concept of inherited characteristics American nationalism required that the English be considered superior to other European nations.

Catholicism and Judaism were outside the pale of Americanism. The American was assumed to be not only English, but Protestant. Sentiments of tolerance were sometimes expressed, but at the same time other religions were depicted as dangerous to American civilization. The American must be a republican, though not necessarily a democrat. He must revere the values already established in American society rather than attempt to establish new ones. He must reject reforms for women's rights, abolition of slavery and the organization of labor. He should be moved by the inhumanity of war, but he should admire the exploits of military heroes. Above all he must recognize the righteousness of the American cause in every war in which the United States had engaged. Of the reform movements current in this period only the public school and temperance movements were acceptable. And the American public school system must confine itself to imparting "useful knowledge;" the fine arts and scholarship should be left to an effete Europe.

For the individual the virtue of serving one's country outweighed all others; Washington was the great hero of these books. In ordinary life the virtues of industry and frugality were considered most vital, and for these God would send the reward of material prosperity. Because America was unique in the economic opportunities that it offered, the man who did not achieve affluence was considered inadequate in the eyes of man and God. Although class fluidity was assumed to be a unique feature of the American scene, class distinctions were to be maintained. The typical American was a self-made man whose efforts benefited his purse, his soul and his country.

The influence of these books clearly tended to

retard social and political change. In the period of Jefferson, Jackson and Lincoln, American school-children were being indoctrinated with the conservative philosophy prevalent in New England in the 1790's.

Microfilm copy of complete manuscript of 476 pages, \$5.95. Enlargements 6" x 8", 10¢ per page.

#### UNIVERSITY REPRESENTATION IN ENGLAND, 1604-1690

(Publication No. 3913)

Millicent Barton Rex, Ph.D.  
Columbia University, 1952

In 1604 a grant of Letters Patent from James I gave each of the universities of Oxford and Cambridge the right to elect two members to sit in the House of Commons. The reasons for this grant are obscure. The universities had petitioned for the privilege at various times throughout the reign of Elizabeth, but it was not until the accession of James I, when Sir Edward Coke interested himself on their behalf, that the franchise was obtained. The King himself seems to have taken no initiative in the matter.

The university members were elected at Cambridge by the Senate and at Oxford by the Convocation. These bodies were chiefly composed of holders of the degree of masters of arts. Non-resident degree-holders as well as residents could vote for parliamentary representatives. The candidates for the seats were supposed to be graduates (or at least former students) of the university they were standing for — or better still, currently in residence. These qualifications, however, were not always strictly observed. The elections were conducted at Cambridge by ballot and at Oxford by the recording of names on a list, sometimes accompanied by a division.

Many famous men occupied the university seats — Sir Francis Bacon, John Selden, Sir Isaac Newton, among the most illustrious; Sir George Calvert, John Thurloe, Sir Matthew Hale, among the lesser celebrities. Sometimes, on the other hand, the universities were served by only minor personages of the day, or even by men who were relatively unknown and undistinguished. On the whole, the possession of a university seat seems to have been regarded as an honor, and the fact that it could be obtained, when available at all, without excessive expenditure, became a more and more desirable feature as the pocket borough system was extended.

The amount of university business to be transacted was never very considerable, except during the Civil War and the Interregnum, when the universities were brought under the close supervision of Parliament. As a rule, the university burgesses were more often occupied with the general affairs of the kingdom, particularly as many of them were members of the Privy Council, secretaries of state, ambassadors, and judges. The interests of the Anglican Church were also regarded as the special concern of all university representatives.

In the early part of the century there was a tendency for the king and the university chancellors to dictate the choice of university members, but the right of the universities to a free election was seldom lost for long. Often a compromise was worked out, whereby one seat was filled with a candidate pleasing to the Court, while the other was left free for the university's choice. Lively contests for the seats occurred from time to time, sometimes between university residents themselves, sometimes between candidates favored by the universities and candidates whose interests were urged by "those above." Such contests were more common after 1660. The only two seriously disputed elections, however, both occurred in the first part of the period — one at Cambridge in 1614, and the other at Oxford in 1625/26.

Most of the university members were on the prerogative side of the controversies of the century, although opposition of the milder sort appeared occasionally, reflecting the political trends of the time. None of the members elected to the Long Parliament, for example, stood with the king during the Civil War, and at the time of the Exclusion Bill, Cambridge elected its first Whig. Oxford, however, tended to become more royalist in the latter part of the Restoration, although its members, along with those of Cambridge accepted the Glorious Revolution in 1689.

Microfilm copy of complete manuscript of 672 pages, \$8.40. Enlargements 6" x 8", 10¢ per page.

#### THE GERMAN EPISCOPATE UNDER EMPEROR HENRY VI

(Publication No. 3799)

Raymond Henry Schmandt, Jr., Ph.D.  
University of Michigan, 1952

The aim of this dissertation is to survey the non-ecclesiastical activity of the bishops of Germany during the period of the reign of Emperor Henry VI in order to determine the bishops' position within the framework of German political and constitutional developments.

Part I of the study concerns the relationship of the bishops and the emperor. All episcopal elections in Germany in the period 1189-1197 are examined for traces of royal intervention in an attempt to formulate the policies of Henry VI in this matter. Particular attention is paid to disputed elections at Cambrai and Liège. Personal data concerning the character of the men elected is also given. The attitude of the bishops toward the crown is presented on the basis of the traditional *servitia*, of their services as royal ambassadors, as military commanders against the Welfs, and supporters of the royal policies as exemplified in the case of the imprisonment of Richard of England. Several instances are given of royal donations to episcopal churches. Examples of opposition to the emperor are surveyed in a discussion of the assassination of Bishop Albert of Liege and its consequences, the association of Hartwich of Bremen with Henry the Lion, and Adolf of Cologne's objections to the emperor's proposal for an hereditary monarchy.



Part II examines the relationship between bishops and nobility. Instances of interference by the nobles in elections at Liège, Utrecht, Cambrai, and Cologne are traced as part of the political programs of the dynasties involved. Henry of Prague's acquisition of the Duchy of Bohemia presents a striking example of opposition between the two classes, and other instances of the same attitude are shown. Transactions between nobles and bishops at Trier, Paderborn, and Hildesheim concerning advocacies indicate the development that institution was undergoing.

Part III surveys the activity of the bishops as territorial princes. Princely rank and mastery of their cities are examined as bases for the development of territorial supremacy. Acquisitions of property and attempts at consolidation of jurisdiction point the way to the future course of German history. The Archbishopric of Cologne receives special attention because of its important position in German economic and political life. Episcopal participation in the crusade of 1197 presents an example of the bishops as both ecclesiastical and secular lords.

Three conclusions can be drawn from the evidence examined. 1) Henry VI's attitude towards the bishops was essentially the same as his father's, and the episcopal princes served him as readily as they had Barbarossa. 2) By this period there are evident definite traces of the shape of the future ecclesiastical principalities. 3) Nevertheless, in 1197 there was little in the activities of the bishops to indicate that the decline of the power of the crown would be as rapid as it actually was after Henry VI's untimely death.

Microfilm copy of complete manuscript of 278 pages, \$3.48. Enlargements 6" x 8", 10¢ per page.

**THE NATIONAL ASSOCIATION OF  
MANUFACTURERS: ORGANIZATION AND  
POLICIES, 1895-1914**

(Publication No. 3679)

Albert Kleckner Steigerwalt, Jr., Ph.D.  
University of Michigan, 1952

The National Association of Manufacturers was organized in 1895 as an attempt by manufacturers to counteract the depression which followed the panic of 1893. From 1895 to 1903 the efforts of the association were directed primarily toward stimulating the development of foreign markets for the products of American factories. In order to implement this policy the National Association of Manufacturers' program called for a federal subsidy to the merchant marine, a reorganized consular service which would be more "trade conscious," an isthmian canal to facilitate trade with the west coast of South America and the Orient, a federal department of commerce and manufactures, and a policy of reciprocity, limited to non-competitive imports, which would enable the manufacturers to continue to benefit from a protective tariff. In ad-

dition to advocating government policies which would assist manufacturers in enlarging their foreign markets, the National Association of Manufacturers developed extensive services for its members who were engaged in foreign trade. It provided them with a foreign freight and transportation bureau, an information bureau which made special studies of foreign markets, and warehouses for the display of American manufactured goods in Caracas and Shanghai. Coincident with the organization's emphasis on foreign trade was its solicitous concern for such aspects of the domestic economy as nation-wide uniformity in state legislation insofar as it applied to manufacturing and commerce.

As a result of the "mass advance" of organized labor after 1897, the association, beginning in 1903, focused its attention on the "labor problem." It came to oppose the growing labor movement and appealed to public opinion to stand by what it deemed "American individualism" and to resist the growth of group standards which were fostered by organized labor. Further to combat trade unionism the National Association of Manufacturers sponsored the Citizens' Industrial Association in 1903, the National Council for Industrial Defense in 1907, "lobbied" in opposition to labor legislation, and engaged in considerable partisan political activity in the years between 1906 and 1913. A Congressional investigation in the latter year effectively ended the direct political activities of the National Association of Manufacturers and cost it considerable prestige in the eyes of the general public.

From 1895 to 1914 the principles and policies of the National Association of Manufacturers showed a precise and orderly development which was to set the pattern for the future of the organization. The association has always attempted to promote the industrial interests of the United States as those interests have been understood by the manufacturing industries which have made up its membership.

Microfilm copy of complete manuscript of 303 pages, \$3.79. Enlargements 6" x 8", 10¢ per page.

**RICHARD WAGNER'S IDEAS ON NATIONALISM,  
CULTURE, AND RELIGION**

(Publication No. 3922)

Alice Stuart Tirrell, Ph.D.  
Columbia University, 1952

In this study of Richard Wagner's Ideas on Nationalism, Culture, and Religion there is presented an objective summary of his views on the essence of the German nation and its relations to the other peoples of Europe, and on the role and importance of religion, myth, and art in the great mission which he believed was allotted to the German people in Europe and in the world. His anti-Semitism and his interpretation of the chief events of his own century along with his political ideas form the substance of the remaining sections.

In the introductory chapter, reasons justifying a

work of this type are given, Wagner's place in history and his purpose in writing his theoretical works are indicated, and the author's method of procedure is briefly described.

The second chapter on "Wagner's Life and the Development of His Ideas" contains a condensed account of the chief biographical facts, and sketches the influence of the Romantic movement, "Young Germany," Feuerbach, Strauss, Schopenhauer, Nietzsche, and Gobineau upon his ideological development.

In the third chapter on "Wagner's Cultural Nationalism," the author discusses Wagner's definitions of the word German and his conception of the essence of Germanism, and recounts the reasons he gives for the cultural superiority of the German people and his belief in their cultural mission to Europe and the world. In order to clarify the importance of this German destiny, Wagner's opinions of the French, English, Spanish, and Italians are also given, while detailed descriptions of his anti-Semitism and of the racial views he derived from Gobineau are included.

Wagner's reaction against historic Christianity and the development of his own religious-philosophical Weltanschauung on the twin themes of redemption and renunciation are related in the fourth chapter, entitled "Religion and Cultural Nationalism." This chapter narrates in detail his condemnation of the Christian tradition and his varying interpretations of Jesus, and shows how "The Religion of the Future," as he called it, was based first on Greek naturalism and Feuerbachian materialism, and later on Schopenhauer's conception of the world as Will and Idea with a dash of Gobineau thrown in.

The "new revelation" designed and destined to bring this "new religion" to the cognizance of mankind was the "Artwork of the Future." Wagner's ideas on each of the components of this Artwork of the Future — Myth, Music, Drama, and the Theater — are explained in chapter five on "Myth and Religion in German Art and Culture." The discussion of the ideological content of the poetry of each of Wagner's music dramas forms the bulk of this chapter. It concludes with Wagner's critique of contemporary civilization, in which he condemned the notion of progress and postulated in its place the belief in the degeneration of mankind because of meat-eating and racial mixture.

In chapter six, entitled "Wagner's Political Nationalism," the composer's "mis"-interpretations of past and contemporary German history are related, while his political theories on the German Folk State, the relation of the State and the King, the King and the Army, Imperialism and Drang nach Osten, the State's Principle, and the Theater as a National Institution are explained. His condemnation of Liberalism, Communism, and Austrian Conservatism are included, and his reaction to the stirring events of 1866 and 1870-71 is traced in detail, as are also his opinions of Garibaldi, Napoleon III, Bismarck and the Hohenzollern Empire.

The concluding chapter attempts to bring together the mass of ideas contained in the foregoing

sections and to evaluate Wagner's opinions and prejudices, both in themselves and in relation to his contemporaries and to succeeding generations, especially Hitler and the Nazis.

Microfilm copy of complete manuscript of 250 pages, \$3.13 Enlargements 6" x 8", 10¢ per page.

#### THE CHALLENGE OF THE WORKING CLASS READER IN GREAT BRITAIN 1790-1848

(Publication No. 3695)

Robert Kiefer Webb, Ph.D.  
Columbia University, 1951

The capricious and inefficient arrangements in British education during the early nineteenth century were supplemented by attempts at "informal" education in discussion groups, in Mechanics' Institutions, and in wide distribution of educational literature. Through the opportunities and stimuli offered, the British working classes attained a wider extension of literacy than has been generally thought; certainly two-thirds to three-quarters of them could read to some degree. The existence of a reading public of this nature in a period of distress and social unrest suggests the larger questions of what ideas they derived from their reading, and of what efforts were made at indoctrination.

The existence of this new reading public was first realized by the upper classes during the French Revolution. The attempts then made to counter the impact of radical literature followed eighteenth-century patterns; dialogues, tales, addresses, and pamphlets, often made up to resemble popular street literature, were published in large numbers by individuals and by loyal associations. An even more extensive effort was made after 1815, when Cobbett and other radical publishers seemed to pose a real threat to public order. In both periods the radical press was successfully hampered or even put down by repressive legislation, but it is clear that the conservative ideas advanced by the upper classes in pamphlets and papers directed to the working classes had little effect but to exasperate the workers further.

In the third decade of the century a new, more positive approach came into use. Denunciation, simple tales, and jokes continued to appear in successive crises, but the significant work was done by those individuals and organizations that had a long-range program. The cheap magazines of the Chambers brothers, the publications of Charles Knight and of the Society for the Diffusion of Useful Knowledge, and the productions of the revitalized Society for Promoting Christian Knowledge are the best known of these efforts. Although it is clear that such publications had little circulation and excited much opposition and ridicule among the intended audience, it is important to examine their nature.

Such an examination can best be done in connection with one of the most notable of the new, fervently held dogmas of the triumphant middle



class — political economy. While other, more basic questions of politics were shunned by all but the most radical of middle class educators, political economy commanded general enthusiasm. The Society for the Diffusion of Useful Knowledge, though hampered by its organization and by timidity, made several significant attempts to teach the science; and the problems and intentions involved in such teaching are made clear through the publications of individual propagandists like Charles Knight, John Wade, William Ellis, and Harriet Martineau.

Beyond general education in political economy, writers turned to the precepts of the science for help in solving certain specific social and economic crises. The agricultural disturbances of 1830 brought forth not only "old-fashioned" tracts from magistrates and clergy, but defenses of machinery addressed by the popularizers of political economy to the rebelling workers. The agitation against the New Poor Law of 1834 brought many writers to its defense, both from a standpoint of Malthusian theory and as a successful practical measure. Finally, the successive waves of trade unionism down to 1848 brought much anti-union publishing by political economists in a vain attempt to dissuade the working classes from what seemed a dangerous social aberration.

The new approach was nearly as ineffectual as the old. The working classes generally were not willing to accept a philosophy which seemed to justify and to prolong the misery and injustice they saw about them. This broad educational movement — a manifestation of the increasing self-assurance of the middle classes — evoked a response in some rising members of the working class, but their very acceptance of it divorced them from the working classes.

Microfilm copy of complete manuscript of 529 pages, \$6.61. Enlargements 6" x 8", 10¢ per page.

## HOME ECONOMICS

### EFFECT OF COOKING TEMPERATURES ON THE QUALITY AND IN VITRO DIGESTIBILITY OF BEEF STEWS AND POT ROASTS

(Publication No. 3943)

Ellen Bek Freeman, Ph.D.  
University of Minnesota, 1952

A review of the literature shows disagreement of the effect of heat on the nutritive value of meat proteins. The present study was planned to determine quality and in vitro digestibility of pressure cooked and of braised beef stews and pot roasts. Raw meat was compared where possible. All results were subjected to statistical analysis.

The beef was top round of commercial grade. Stew pieces were 1 1/2 by 1 by 1 inch, and each pot

roast weighed about 2 1/2 pounds. All meat was browned. Pressure cooked stews were cooked at 117.5°C. (approximately 15 pounds pressure) for 18 minutes; pressure cooked pot roasts were cooked at the same temperature 30 minutes. Conventionally cooked stews were cooked at the boiling point of water for 1 1/2 hours, pot roasts for 3 hours. Iron-constantan thermocouples were used to measure the temperature within the pans and to follow the course of heat penetration in the meat. Heat penetration curves were plotted. All meat was weighed before and after cooking, and weight losses were calculated. Cooking broths were analyzed for amino nitrogen and total nitrogen.

Objective tests for quality were shear force determinations for tenderness and press fluid tests for juiciness. Conventional pot roasts showed significantly lower shear force readings than raw or other cooked meats, which did not differ significantly. All cooked beef gave highly significantly less press fluid than raw beef. Pressure cooked and conventional stews were not significantly different in press fluid, but pressure cooked pot roasts yielded significantly more press fluid than conventionally cooked roasts. Pot roasts gave highly significantly more press fluid than stews.

Samples of ground beef from each cooking series, with comparable samples of ground raw beef, were subjected to in vitro digestion. Meats in 0.1N hydrochloric acid were digested with pepsin for 48 hours at 38°C. (digest pH 1.5 to 2.0). One third of these digests were then analyzed. The remaining digests were subjected to trypsin for 48 hours at 38°C. and pH 8.3; half of these were analyzed. The remaining samples were digested with erepsin for 48 hours at 38°C. and pH 7.8 and then analyzed. Analyses for total nitrogen (Kjeldahl), amino nitrogen (Van Slyke), and acid-insoluble residue nitrogen were made. The degree of digestion was calculated by dividing the weight of amino nitrogen per digest by the weight of total nitrogen in the digest and multiplying the quotient by 100. For both stews and pot roasts, variations in degree of digestion due to extent or method of cooking were non-significant. The mean degree of digestion for pot roasts was highly significantly lower than for stews. More acid-insoluble residue nitrogen resulted from pepsin digestion of raw than of cooked beef, while with pepsin-trypsin and pepsin-trypsin-erepsin combinations cooked beef yielded more residue nitrogen. Pressure cooked and conventionally cooked meats gave similar amounts of residue nitrogen.

Microfilm copy of complete manuscript of 108 pages, \$1.35. Enlargements 6" x 8", 10¢ per page.

## POLITICAL SCIENCE

SOME ASPECTS OF VOTING BEHAVIOR IN  
FLINT, MICHIGAN — A CITY WITH  
NONPARTISAN MUNICIPAL ELECTIONS

(Publication No. 3737)

Carroll Hamilton Clark, Ph.D.  
University of Michigan, 1952

Rather broad generalizations have been made by both the proponents and opponents of nonpartisan municipal elections. The purpose of this inquiry is to determine whether these generalizations have been validated by actual experience in a city which has had nonpartisan municipal elections since 1930.

Part One presents the necessary background. There is a survey of the conflicting views of publicists with regard to nonpartisan elections as well as the extent of the use of such elections in cities with different forms of municipal government. A brief account of the past and present forms of government in Flint, together with the growth and characteristics of the city's electorate, aids in understanding what follows.

The background material makes it clear that one can cite seemingly sound *a priori* arguments for or against nonpartisan municipal elections. The subject is not merely academic since an increasing number of cities have adopted the practice. In Flint, a rapidly growing city dominated by the automotive industry, the change from partisan to nonpartisan city elections was a relatively uncontroversial aspect of a change in the form of municipal government.

Part Two is more directly concerned with voting behavior in Flint. Voting behavior is approached from the standpoint of participation in both partisan and nonpartisan elections. The nine wards — which vary markedly with regard to economic status, native born whites, foreign born whites, and Negroes — are compared statistically.

As a further test of the validity of the generalizations with regard to nonpartisan municipal elections, the Flint experience is compared with that of another Michigan city which has the same type of city elections and with one which has partisan city elections. The study also includes an examination of various forces which have had an impact on the local elections in Flint.

The characteristics of nominees to Flint's governing body are analyzed. Interest in partisan matters, based on the space devoted to partisan news in the local daily newspaper and retention of party loyalty, based on the vote for Secretary of State, are examined.

The following negative conclusions can be drawn with regard to city nonpartisan elections in Flint. They have:

(1) Not followed a similar pattern in Flint and Grand Rapids, Michigan (which also has nonpartisan municipal elections).

(2) Not lessened continuity of service on the governing body.

(3) Not decreased participation in partisan elections as compared with Ann Arbor, Michigan — a city with partisan city elections.

(4) Not been followed by a decrease in the vote for partisan candidates.

(5) Not been followed by a decline in straight ticket voting as reflected in the vote for Secretary of State.

(6) Not led to decreased interest in partisan news as measured by space devoted to partisan news in the local daily newspaper.

As a final conclusion, it is clear that broad generalizations as to the effects of nonpartisan municipal elections are unwise.

Microfilm copy of complete manuscript of 128 pages, \$1.60. Enlargements 6" x 8", 10¢ per page.

PARLIAMENTARY CONTROL OF THE BRITISH  
NATIONALIZED INDUSTRIES

(Publication No. 3942)

Robert Younger Fluno, Ph.D.  
University of Minnesota, 1952

The industrial areas nationalized by the Labour Government in Great Britain in the period following the Second World War provide a useful source of material for the study of intervention by a democratic government in the economic life of a nation. An effort was made to achieve a form of control which would permit both the degree of managerial discretion considered necessary to ensure efficiency and the amount of political control essential to the aims of economic democracy. This was to be accomplished through the scheme of governmental organization known as the public corporation.

This study is an examination of certain phases of the attempt to obtain both democratic control and administrative autonomy. Using evidence found in parliamentary debates and in the reports of the corporation boards, it asks two questions. Was the attempt to distinguish areas of day-to-day management from matters of policy a successful one? Was the degree of ministerial control over the industries commensurate with the degree of ministerial accountability to Parliament?

An examination was made of all of the parliamentary questions asked and of all of the debates on the newly nationalized industries between the dates of the vesting of their assets to the government and January, 1951. In addition, the annual reports published before August, 1951, were examined for evidences of ministerial influence over the corporations.

There was a general assumption that the distinction between matters of day-to-day management or administration and those of general policy provided the proper basis for drawing a line between areas of ministerial control and areas of autonomy. However, an examination of the actual pattern of differentiation as shown in parliamentary questions and statements in debates failed to show a clear line of distinction.



In the first place, a great many areas of ministerial intervention and accountability could be explained by grants of authority either from the nationalization statutes themselves or from other acts of Parliament.

Secondly, there were both theoretical and practical attitudes on the part of the ministries in differentiating areas of control and independence. In some instances there was evidence that the common sense of administrative discretion entered the decision to intervene. Elsewhere, matters which were in the public eye either because of political controversy or economic importance appeared to become areas of control and accountability. Thus, in addition to the attempt to set out a pre-determined, theoretical line of differentiation, there was also a tendency to intervene when it seemed common sense to do so.

Thirdly, there was more than one criterion used in achieving the theoretical policy-administrative distinction. Matters considered to be properly the subject of control were: the general as opposed to the particular; matters of production as opposed to administration; and non-commercial activities as opposed to the commercial affairs of the industries. Thus, although the pattern of differentiation evolved may be a practical one and may become clear through the establishment of precedent, it can hardly be said to be a single, precise line.

In answer to the second question, the nature of partial responsibility plus the amount of informal control makes any concrete statement of the degree of influence impossible. However, ministerial influence seems almost inevitably to exceed accountability. Since the extent of influence is probably not even known to the ministers or the boards, it is impossible to say whether the excess of influence over accountability constitutes a threat to practical democratic control. The possibility of such an excess, however, makes it necessary to continually re-examine the system of control to make certain that a practical balance of accountability and autonomy exists.

Microfilm copy of complete manuscript of 213 pages, \$2.66. Enlargements 6" x 8", 10¢ per page.

#### THE PUBLICISTS AND LAISSEZ FAIRE CONSTITUTIONAL PRINCIPLES

(Publication No. 3771)

Clyde Edward Jacobs, Ph.D.  
University of Michigan, 1952

The purpose of this study is to describe and evaluate the influence of certain law writers upon the growth and development of American constitutional law during the half-century following the Civil War. Emphasis has been placed upon the works of three writers of this period — Thomas M. Cooley, Christopher G. Tiedeman and John F. Dillon.

The introductory chapter, which is based largely

upon secondary source materials, was written with two ends in view: (1) to sketch the origins and growth of constitutional principles which, in the era preceding the Civil War, were major bulwarks of property rights and (2) to show the process whereby, and the reasons for which, these guarantees ceased to satisfy conservative interests. It is concluded that, on the eve of the Civil War, a new set of constitutional principles was in demand by conservatives, particularly by the ascendant industrial capitalists.

In the second chapter a discussion of the origins and early development of the liberty of contract doctrine is presented. The contributions made by Cooley and Tiedeman are emphasized, and numerous state and federal cases in which the principal elements of the liberty of contract doctrine received judicial approval are summarized. The third chapter is devoted to a discussion of: (1) the applications of the liberty of contract principle by state tribunals, (2) the process whereby the Supreme Court of the United States came to accept the principle as a limitation upon state and national powers and (3) the eventual decline of the principle.

The fourth chapter presents an analysis of the origins and development of the public purpose maxim as a limitation upon the taxing and spending powers of the state legislatures. The importance of the works of Cooley and Dillon to the growth of the maxim, as a constitutional principle encompassing laissez faire ideas, is emphasized. State and federal cases in which the public purpose maxim received various applications are analyzed in the fifth chapter. This chapter includes an account of the decline of the public purpose maxim as an important check on legislative power.

In the sixth, and final, chapter is presented an evaluation of the influence of Cooley, Tiedeman and Dillon upon American constitutional law during the post-Civil War era. Three correlative conclusions emerge from this study. (1) The works of the aforementioned publicists exercised great influence upon the legal profession during the half-century following the Civil War. (2) The works of these writers were instrumental in bringing about the incorporation of laissez faire political and economic ideas into American constitutional law. (3) These writers share, with the judges and the lawyers, the distinction of having devised and constructed a constitutional order which, in many respects, reflected the fears and aspirations of industrial capitalists.

Microfilm copy of complete manuscript of 341 pages, \$4.26. Enlargements 6" x 8", 10¢ per page.

COMMENTARIES ON  
THE CONSTITUTION, 1865-1900

(Publication No. 3897)

Charles Edward Larsen, Ph.D.  
Columbia University, 1952

The major commentators on American constitutional law in the period 1865-1900 were Thomas M. Cooley, John N. Pomeroy, John F. Dillon, Christopher G. Tiedeman, John I. C. Hare, Samuel F. Miller, John Ordronaux, Henry C. Black, Roger S. Foster, and John R. Tucker. Their treatises were similar to other legal commentaries in purporting simply to describe the condition of a given field of law primarily by summarizing judicial decisions. Actually they often went further and made qualitative judgments in ethics and political theory. In this respect they were especially concerned with two issues, the nature of American federalism and the trend toward increased regulation of the economy. Most of the commentators were nationalists and vehemently criticized Southern views on nullification and secession. But they also were conservatives and did not desire any substantial expansion of federal power. In their treatment of the Constitution they all stressed the necessity of preserving such basic institutions and practices as separation of powers, checks and balances, and distribution of powers. Their conservatism was ultimately stronger than their nationalism and they came to emphasize the dangers of excessive centralization (which they often equated with socialism) as more real than the menace of theories of states' rights. The commentators vigorously asserted that attacks on property rights would surely be followed by the loss of all natural and civil rights. In formulating their defense of conservatism they relied primarily upon seventeenth and eighteenth century theories of natural rights, especially the writings of the Fathers. A few of them (Cooley, Tiedeman, Tucker) approvingly referred to Herbert Spencer's writings. The outstanding contribution among the commentaries to a constitutional defense against governmental intervention was Thomas M. Cooley's Constitutional Limitations (1868). This treatise was an influential factor in the development of the substantive interpretation of the due process clause of the Fourteenth Amendment. Cooley equated due process clauses or their equivalents in the state constitutions with the thirty-ninth chapter of Magna Carta and concluded that they imposed general limitations on all branches of government. These limitations were not merely procedural but forbade all unreasonable intervention by government with private rights, according to Cooley. The treatise was cited in laudatory language as a reliable authority by members of the Supreme Court and in a number of cases dealing with the due process clause of the Fourteenth Amendment it was called the most accurate statement available of the meaning of that clause. Commentaries were also used by lawyers in preparing their briefs for the Court. Several of them were used as texts in law schools and liberal arts colleges. Aside

from Cooley's treatise, however, most of them derive their importance as reflections of the conservative thought of a segment of the legal profession on constitutional and political theory during the latter part of the nineteenth century. In the twentieth century the extension of federal power and the development of administrative law, as well as increased specialization in the social sciences and the growth of legal periodical literature, have made the classic commentary on the Constitution an outmoded form of legal literature.

Microfilm copy of complete manuscript of 305 pages, \$3.81. Enlargements 6" x 8", 10¢ per page.

FISCAL CAPACITY AND STATE AID  
IN MICHIGAN COUNTIES

(Publication No. 3780)

James Edward Larson, Ph.D.  
University of Michigan, 1952

The process of evolution from the simple agrarian to the more complex industrial state of today has produced for the local units in Michigan new ratios of general public need to taxable resources. Michigan has seen the past relatively satisfactory distribution of public need and resources among its political subdivisions supplanted by new and unbalanced resource-need ratios. These new ratios, which by nature tend to be unstable in direct relation to the fluidity of population, have operated to produce stresses in local finance. The inability of local units to maintain fiscal solvency under these conditions has been met in part by state action in the form of grants-in-aid.

The grant-in-aid in its various forms is the most satisfactory means of compensating for variations in resource-need relationships. As reported by the Auditor General of the State of Michigan, sixty-four individual programs of aid to local units were operative in fiscal 1950. The total amount of aid was \$343,180,631. This figure was \$13,762,851 in excess of property tax levies by the local units for that year. While the grant-in-aid or any other type of financial assistance extended by a state to the local unit stems normally from a recognized non-coincidence of service and taxing jurisdictions, proper application of the grant depends upon adequate measures of fiscal capacity, need, and effort in the units concerned.

The fiscal capacity of a governmental unit may be defined as that portion of the economic resources of the unit subject to the existing tax system. At the state level, authorities of the subject now regard income payments as the most satisfactory index of fiscal capacity. For the local units with restricted tax resources, income does not provide a suitable basis for estimating fiscal capacity. The only valid measure of fiscal capacity for most local units is property valuations. For comparative purposes, these valuations must be "equalized," or based on a common ratio of assessed to actual value.



Measured by 1949 state-equalized valuations, and reduced to per capita terms, the fiscal capacity of Michigan's counties ranges from \$3459 in Midland County to \$960 for Alger County. Similar variations exist in 1949-50 per capita tax levies: per capita public need in St. Clair County can be met only through a tax levy amounting to \$16.64 per capita; in Luce County, \$4.62 per capita is sufficient. Tax rates, as calculated from state equalized valuations and local levies, provide both measures of effort and suitable indexes of existing resource-need ratios among the counties. The highest effort in terms of tax rate was exerted by Schoolcraft County; the lowest effort was that of Midland County.

Presented graphically, the relationship of county fiscal capacity, public need, and tax effort to state aid is made clear. It is shown conclusively that state aid to counties for the three aid programs of highways, health, and welfare is without a consistent pattern relative to county ability, need, or effort. Aid is returned generously or in limited amounts quite apart from considerations of equalization.

Microfilm copy of complete manuscript of 88 pages, \$1.10. Enlargements 6" x 8", 10¢ per page.

#### THE HELLENIC CONSTITUTIONAL CRISIS, 1915

(Publication No. 3038)

Achilles Nicholas Sakellarides, Ph.D.  
Princeton University, 1941

Abstract not available.

Microfilm copy of complete manuscript of 440 pages, \$5.50. Enlargements 6" x 8", 10¢ per page.

#### INDIA'S POLICY IN THE UNITED NATIONS WITH SPECIAL RESPECT TO THE MAINTENANCE OF INTERNATIONAL PEACE AND SECURITY (BEING A STUDY OF SELECTED QUESTIONS, DISPUTES AND SITUATIONS)

(Publication No. 3923)

Shanti Narayan Varma, Ph.D.  
Columbia University, 1952

In a world torn with bitter international rivalry among the great Powers in which the nations of the world are arrayed in two hostile camps, the Indian policy of non-alignment is a subject deserving careful and objective study. Accordingly, this dissertation comprises a study of carefully selected questions, disputes and situations which cover the general field of international peace and security and in which India has taken a substantial part. The source material is based primarily on an extensive analysis of the records of debates in the General Assembly, in its Political and Security Committee, and in the Security Council. Official statements on foreign policy and the debates in the Indian Parliament have been referred to as an additional source of information.

The general plan of the thesis is as follows:

In an introductory chapter the evolution of India's international status is traced, beginning with her participation in the Empire Conferences, the Paris Peace Conference, the League of Nations and the San Francisco Conference. It is of interest to note that in all of these conferences India occupied a peculiar position, being a dependency. In fact, she was the only dependency which was privileged to participate in world conferences of the highest importance.

In part one (chapters II and III), India's position is examined with respect to two important organizational questions, namely, the question of the admission of new Members, including the question of the representation of the Government of China in the United Nations, and the question of the use of the veto in the Security Council. On both these questions the position taken by India in general has been to attempt a reconciliation of the opposing viewpoints between the two power blocs. The Indian representatives have held the view that the deadlock over the question of the admission of new Members and the refusal to restrict the use of the veto are manifestations of the great-Power rivalry and the resulting international tension, and that no useful purpose will be served by attempting a solution of these questions in the United Nations without a corresponding effort to bring about a general understanding between the great Powers and thereby a relaxation of the growing international tension.

In part two (chapters IV-XI), the Indian position has been examined in the following cases; the Indian in South Africa question, the Palestine question, the Kashmir and Hyderabad disputes, the Indonesian question, the question of the former Italian colonies, the Korean question, and the question of armament regulation and limitation. Since India's policy in the Kashmir and Hyderabad disputes and the Korean question have been the subjects of controversy throughout the world, an examination of the Indian position in the light of these comments has been exhaustively treated.

The general conclusions are presented in three separate sections. The first section states the basic principles and objectives of the Indian policy in the United Nations, namely, the promotion of world peace by pursuing a policy of non-alignment and the examination of each question independently and on its merits, the liberation of all subject peoples by opposing all forms of colonial and imperial domination, the elimination of racial discrimination, and a whole-hearted co-operation and unreserved adherence to the purposes and principles of the Charter.

In the second section are examined the bases of these objectives of the Indian policy, such as India's past cultural and historical background, the special position that she occupies in Asia, the present-day political and economic needs, and the requirements of defence. In the third section an appraisal of the Indian policy has been made, particularly the general effect and the reception this policy has had in the present-day world situation.

The over-all emphasis on world peace has been the cornerstone of the Indian policy. In the pursuit of

this policy India demands that the United Nations should direct its efforts toward the elimination of causes of war, such as economic maladjustment and social injustice, rather than perfect the machinery of collective action alone.

Microfilm copy of complete manuscript of 417 pages, \$5.21. Enlargements 6" x 8", 10¢ per page.

## PUBLIC ADMINISTRATION

### MUNICIPAL REGULATORY LICENSING: A STUDY OF SIXTEEN AMERICAN CITIES

(Publication No. 3681)

Blanche Davis Blank, Ph.D.  
Columbia University, 1951

This study is based primarily on field research and interviews with over seventy officials in sixteen selected cities with over 100,000 population. Background material was also gathered through direct mail inquiry and the use of two questionnaires that appear as appendices to the dissertation. The term licensing is defined in the introduction as an "administrative lifting of a legislative prohibition," and is distinguished from such other terms as license tax and permit. The history of licensing in both its English origin and its colonial American usage is cited to give evidence of its early regulatory character. Special attention is paid to the position of licensing in a federal government, and to the Constitutional and legal restrictions on municipal licensing. The problem of state and local cooperation and duplication is also mentioned.

The next two chapters deal with the potential benefits and abuses that can be expected from municipal regulatory licensing. Thirteen possible public benefits from the insuring of skill in dangerous trades to the reduction of crime and juvenile delinquency are described as deriving from an intelligently and honestly administered licensing system. The possible abuses are divided into examples of licensing "misdirection," in which the practice is ill advised but not venal or criminal; and licensing "corruption," in which the ultimate purpose of the license is to increase the wealth or power of the individual utilizing it. In the first category are such practices as discriminating against non-local merchants, while the corrupt uses of licensing include items like the use of licensing for political patronage and graft.

Chapter four is a survey of the administrative advantages of regulatory licensing. The license is contrasted favorably against other forms of business control such as private adversary action, certification, public aid to business, and statutory fines and punishments. Administrative forms of control such as dispensing powers, directing powers, examining powers, and summary powers

are given particularly close attention.

The scope of municipal regulatory licensing is presented in chapter five as covering over two hundred items. A table is included showing the frequency of ninety-three of the most common items among the sixteen cities. The license laws themselves are discussed next and four major drawbacks are cited as being currently prevalent: 1) lack of convenient indexing and compilation, 2) lack of summaries for distribution among license applicants, 3) incompleteness, and 4) duplication, obsolescence, and confusion.

The advantages and limitations of license centralization are set forth in chapter seven, and a brief is made for "simplification" rather than thoroughgoing centralization. The variety of license forms and records are described and suggestions made for their possible improvement in the following chapter. Next, license inspections are thoroughly discussed and the need for adequate training and interdepartmental consolidation is stressed.

Chapter ten is a detailed analysis of the problems of administrative discretion involved in regulatory licensing under the classification: prudential discretion, mediating discretion, expert discretion, and reserve discretion. The functions of licensing discretion are described as: achieving flexibility, arriving at a definite general rule, and attaining a standard not yet reached in the law.

The next three chapters are devoted to rulemaking procedures and license enforcement. Enforcement practices are divided into those of a precautionary nature (such as applicant interviews, initial inspections, use of bonding and fingerprinting), and those of a punitive nature (including license renewals, suspensions, and revocations).

The study concludes with a review of two special licensing problems, censorship and public relations, the former as an unnecessary evil, the latter as a necessary but largely non-existent benefit. There is also a final summary chapter on the highlights of the paper.

Microfilm copy of complete manuscript of 293 pages, \$3.66. Enlargements 6" x 8", 10¢ per page.

## SOCIOLOGY

### COOPERATIVE GROUP FORMATION: A PROBLEM IN SOCIAL ENGINEERING

(Publication No. 3940)

James Cooke Brown, Ph.D.  
University of Minnesota, 1952

This work is a sociological study over an 18-months period of the formation, growth, and dissolution of a small cooperative living group (twelve members). The group, known as the "Minneapolis Group," formed in the Fall of 1947 among students



of the University of Minnesota, most of whom were veterans of World War II, and moved to Los Angeles in the Summer of 1948, where it planned to found a utopian colony along "scientific" lines, and there dissolved in the Winter of 1948-49.

The group was therefore part of a post-war social movement of utopian idealism which has been largely abortive in the U. S. A. but fairly successful elsewhere, notably in post-war France. By this is meant that the Minneapolis Group was only one of a number of such groups which sprang up in America at about this time, independently and largely unknown to each other, all save two of which have failed to survive. The Minneapolis Group is assumed to be a representative instance of the failure of utopian ventures in the U. S. A. since their period of success in the mid-19th Century. Historical materials are examined in the first part of the work and the hypothesis derived that the success of utopian colonies is a function of previous homogeneity of values among the members.

The remainder of the work is devoted to analyzing the reasons for the failure of the Minneapolis Group. Fortunately for this purpose, the "scientific" orientation of the group permitted the gathering of objective data during the period of its formation and early growth. The author was a member of the group and his research was undertaken with the purpose of informing the group as to the patterns and processes of its growth. These studies are reported on, in retrospect, in the second section. Among them were (1) a study of congeniality patterns in the group and an attempt to predict the degree of congeniality of new-comers to the group; (2) an attempt to predict the probability of contacted persons' joining the group on the basis of an original battery of attitude scales; and (3) an attempt to mediate the group's essentially anarchistic theory of social control by sociometric studies of "mutual respect" patterns within the group. The findings were, respectively: (1) that congeniality within the group and between the group and its periphery of "interested persons" was a predictable function of agreement on a certain set of "radical" values; (2) that differences in attitudes toward political, economic, religious and sexual-marital values were sufficient to discriminate "interested persons" from the general population of college students, while sexual-marital values alone were sufficient to discriminate active members from the "interested" population; and (3) that the group did possess a multi-centered leadership structure but failed to develop the "co-ordinate status" relationships to which it aspired.

The third and final section is devoted to an historical account of the decline of the group from this early period of growth. Quantitative data are lacking for this period but it is clear that the development of an ideological conflict with the periphery was a precipitating cause of its decline. The case of the Minneapolis Group thus refutes the hypothesis by which it was formed by appearing to have satisfied the condition of internal homogeneity but nevertheless to have failed because of its relationship

to the external world. Certain suggestions toward a general theory of social movements are put forward in the light of this finding.

Microfilm copy of complete manuscript of 484 pages, \$6.05. Enlargements 6" x 8", 10¢ per page.

## A SCALE FOR THE MEASUREMENT OF GROUP COHESIVENESS

(Publication No. 3931)

Bernard Goldman, Ph.D.  
University of Buffalo, 1952

The purpose of this study was to construct a scale that could measure the degree of group cohesiveness.

A definition or formulation of group cohesiveness was arrived at through a review of previous studies on group morale and group cohesiveness. This review led the writer to the conclusion that no real difference of meaning existed between the two terms - indeed, many writers used the terms synonymously. Previous studies, however, served to focus attention upon certain apparently relevant aspects of group morale or group cohesiveness. These aspects have been summarized by Newcomb. With slight modifications, the writer chose to use Newcomb's summary as a working hypothesis on the basis of which to construct a scale to measure the degree of group cohesiveness.

Group cohesiveness was assumed to exist when five conditions or criteria were met. These were: (1) "satisfaction of individual motives," (2) "satisfaction with interpersonal relations," (3) "shared task involvement," (4) "homogeneity of attitude," and (5) "satisfaction with leadership." Justification for, and criticism of the inclusion of these five criteria were stated.

Items which were presumably measures of the five criteria of cohesiveness were formulated. These items were constructed into a scale by employing Edwards' modification of the scaling procedures used by Thurstone and Likert. The reliability of the scale proved to be satisfactory. The split half reliability for the total scores on the scale based on 209 cases was .88 ± .02 which was raised to .94 when corrected by the Spearman-Brown prophecy formula.

An attempt to validate the scale was made by administering it to various groups, the cohesiveness or non-cohesiveness of which was presumed to be known. The groups were: (1) a Great Books group, which consisted of five sub-groups.

(2) Three University of Buffalo Campus Groups.

(3) Three University of Buffalo Classroom groups.

(4) Three union labor groups.

The final scale was administered to 275 individuals distributed over the various groups.

Conclusions indicate:

1. An analysis of variance between the total scores on the scale indicates that the scale is valid for groups tested when the groups differ in their

degrees of cohesiveness. The scale does not appear to be sensitive enough to discriminate between groups with only slight differences in cohesiveness.

2. That four of the five criteria of cohesiveness adopted for the purpose of constructing the scale are probably valid measures, in part, of group cohesiveness. (Items on "shared task involvement" were not included because phi coefficients were too small.) This conclusion was arrived at by correlating the total scores of each of the four criteria against the total scores on the scale. Although the total scores on all four criteria correlate with the total scores on the scale, only two of the correlations are considered to be sufficiently high to warrant clear evidence for validity. The remaining two correlations may be taken as rather suggestive evidence for the validity of the criteria.

3. The four criteria of cohesiveness are relatively independent of one another as shown by the low intercorrelations among them.

Microfilm copy of complete manuscript of 163 pages, \$2.04. Enlargements 6" x 8", 10¢ per page.

THE DYNAMICS OF TOLERANCE: A STUDY  
OF SOCIAL AND PSYCHOLOGICAL FACTORS IN  
THE DEVELOPMENT OF ETHNIC ATTITUDES  
AMONG CERTAIN COLLEGE STUDENTS

(Publication No. 3900)

Jerome Himelhoch, Ph.D.  
Columbia University, 1952

**Hypotheses.** — (1) For many groups in American society there is a common general attitude factor underlying attitudes toward specific ethnic outgroups; and, in the case of members of disprivileged minorities, this common factor also underlies the attitude toward the ethnic ingroup. (2) In our heterogeneous American society there is subcultural variation in ethnic beliefs. Individuals who play roles in groups with conflicting ideologies will tend in some manner to respond to both influences. (3) Because generalized ethnic prejudice satisfies certain needs which constitute the "authoritarian" syndrome, relatively authoritarian persons tend to be more prejudiced than relatively non-authoritarian persons.

**The sample and the instruments of observation.** — A questionnaire was administered to 490 New York University students and to 235 of their parents; and an autobiographical schedule and the group Rorschach test were administered to student subsamples. While the students varied in class status and ethnic group, the sample was predominantly Jewish and middle class. We included in our questionnaire the Ethnocentrism, Political and Economic Conservatism, and F personality scales, which were taken from the Berkeley Public Opinion Study. In order to contribute to the validation of the F scale (which purports to measure the traits of the authoritarian syndrome), we developed a Rorschach scale, which could be interpreted as revealing degree of

authoritarianism. This Rorschach scale discriminated statistically between high and low F scorers.

**Substantive results.** — (1) Consistent with the first hypothesis, prejudice toward any one outgroup was correlated with prejudice toward each of the other outgroups. Additional intercorrelations suggested the presence of an even more general common attitude factor which was variously manifested by intense patriotism, political conservatism, hostility toward ethnic outgroups, and, in the case of members of minorities, by hostility toward the ethnic ingroup also. (2) In keeping with hypothesis 2, certain subcultural groups differed from others in generalized tolerance. Jews were less prejudiced, conservative, and authoritarian than non-Jews. Women were somewhat more tolerant than men. Age, veteran and social class status did not show any influence upon ethnic ideology. (3) In comparison with the Berkeley Study sample, and also in comparison with their own parents, the NYU students were extremely tolerant, liberal, and non-authoritarian. Correlations between parent and student Ethnocentrism scores suggested that the family role had some influence, albeit small, upon the student attitude. At the same time, virtually all the students diverged in the tolerant direction from their parents. Previous studies, as well as our own, demonstrated that both the general college experience and specific aspects of that experience were associated with tolerance. It was not, however, clear from our data whether the student equalitarian ideology resulted from the college experience or from self-selection or from a combination of these factors. (4) In the Berkeley Study and NYU samples substantial correlations of about the same magnitude were found between the Ethnocentrism score and the F (authoritarian personality) score. This was consistent with the third hypothesis. Among the Jewish and Catholic students, authoritarianism was associated with prejudice toward the ethnic ingroup. Moreover, the non-authoritarians tended to be political and economic liberals, but the relationship was not so close as that between non-authoritarianism and ethnic tolerance. The clinically observed authoritarian character traits, which were present in mild degree in the less tolerant NYU students and which, to a greater degree, were found to characterize the most bigoted members of the Berkeley Study sample, were revealed in a most extreme form in our analysis of the Rorschach test protocols of the Nazi defendants at the Nuremberg Trials.

Microfilm copy of complete manuscript of 202 pages, \$2.53. Enlargements 6" x 8", 10¢ per page.



# **SOME STATISTICAL PATTERNS OF MARRIAGE IN THE UNITED STATES**

(Publication No. 3894)

Paul Harold Jacobson, Ph.D.  
Columbia University, 1952

This monograph is based on published census and registration data as well as on original statistics compiled by the author. The material is organized into four major sections.

The first reviews in detail our national system of marriage and divorce statistics, including the history, source, and validity of available census and registration data. Two highlights emerge from this review. Although information on the marital status of the population has been collected decennially since 1880, less than one half of divorced persons have ever been correctly enumerated. Registration data on marriage and divorce also have many limitations. This is due primarily to the absence of a permanent comprehensive registration plan for the country, including essentially-uniform state records and procedures. Such a plan is outlined by the author.

The second section deals with the trend of marriage. Short-run fluctuations are analyzed in terms of the supply of marriage eligibles, the business cycle, and wars. The last covers the effects of the conflicts from the Civil War through the Korean War, and includes a discussion of international trends, overseas marriages, and a detailed comparison of events with marriages by month from January 1939 forward. The data indicate that the marriage rate has been subject to increasingly marked swings with each recent war, depression and boom. These events, however, do not appear to have had an equal effect on the chances for eventual marriage of all population groups. Widows, for example, benefited from the rise in marriages which followed World War I, but lost out by the decline during the depression of the 1930's. It is also shown that the marriage rate swung upward around 1900 due to a gradual increase in the proportion of the population that marries and a small decline in the age at marriage.

The third section considers the seasonal pattern of marriage in the light of religious customs, climate, occupation, socio-economic conditions, and other factors. June is now the most popular month for marriage in the United States, except in the rural South and among the Negro population. June is most frequently chosen by single girls. While remarrying brides likewise prefer June, their weddings are more evenly distributed over the year. Autumn marriages appear to have greater appeal to older women of all marital classes.

The final section is devoted to geographic variations in marriage and their relation to state laws. Marriages tend to be relatively more frequent as one moves from North to South, and from East to West. More precise analysis by state or locality cannot be made, since available statistics are by place of occurrence and thus mainly reflect variations

in the frequency of nonresident marriages. This is the primary reason for the wide range of rates among the states. Moreover, the distribution of nonresident marriages shifts markedly as new marital regulations are enacted. A popular statute during the 1920's and 1930's was the requirement of a waiting period. More recently, the trend has been toward legislation requiring premarital examinations. Despite such laws, however, nonresident marriages have not declined, and there are 50 so-called "Gretna Greens" in the country.

Microfilm copy of complete manuscript of 188 pages, \$2.35. Enlargements 6" x 8", 10¢ per page.

# **ON THE DIFFERENTIATION OF ECOLOGICAL UNITS**

(Publication No. 3777)

Leslie Kish, Ph.D.  
University of Michigan, 1952

This study has two complementary purposes. First, it calls attention to the desirability of research on the differentiation among ecological units; and it proposes the intraclass correlation as its measure. Secondly, the methodological tool is applied to test some hypotheses regarding the differentiation among suburbs in metropolitan areas.

Previous research has demonstrated the variation in the degree of organization with the strength of the metropolitan influence. Sociological theory postulates that organization and differentiation are interrelated. Therefore, the amount of differentiation among suburban ecological units should vary with the metropolitan influence. Several minor hypotheses are derived to translate that influence into operational terms; the most important one concerns distance from the center.

The measurements were based on published 1940 Census data regarding incorporated places; three characteristics of dwellings and five others of individuals were used. In addition, voting behavior was studied in small part. The investigation was made in eleven large metropolitan areas, and also in two state-wide combinations of smaller areas.

The measurements were made separately for five size classes of suburbs within each of about six distance zones depending on the extent of the area, up to a distance of roughly forty miles from the metropolitan center. A group of units comprised all the incorporated places of one size class within a distance zone. The coefficient of intraclass correlation measured the amount of differentiation among the units of each group. These measures were averaged to provide more stable results.

The empirical results demonstrate that the differentiation among incorporated places is considerably greater near the metropolitan center than farther out. The amounts of differentiation for the several characteristics studied had consistent patterns over the thirteen investigated areas. This effect of

the metropolitan influence was particularly strong for the characteristics of rental value, of proportions of non-whites, of proportions in selected occupations, and of voting behavior. On the other hand, the effect was not demonstrated for those three demographic characteristics which showed unexpectedly great stability: the proportions of males, of children, and of the labor force.

The pattern that seems to emerge is that of a primary communal area in which the suburban places are highly differentiated with regard to many population characteristics. This primary area is about twenty miles wide around the largest metropolitan cities, and only five miles wide for the smaller ones. Beyond those boundaries the degree of differentiation falls rapidly to a lower level.

The greater differentiation among the suburbs near the metropolis is an expression of its organizing influence. This segregation of the population

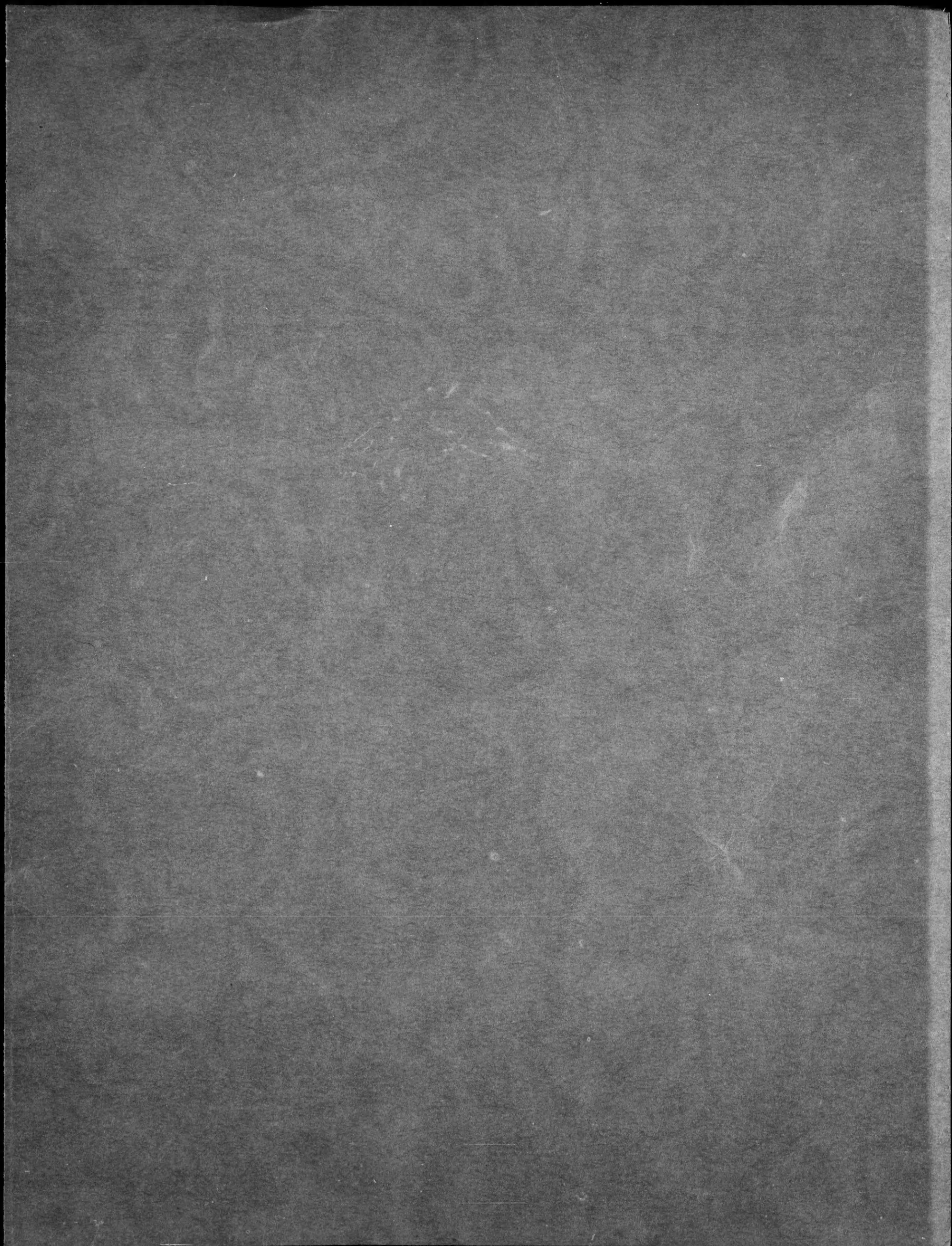
into differentiated suburbs may represent a socially important trend, since the enlarged interdependent metropolitan community is a growing modern phenomenon.

Previous studies of the metropolitan area have compared only the averages of the ecological units within the different concentric zones. The inclusion of the measurement of differentiation among the units enhances our knowledge regarding the composition of those units. Differentiation among a group of units expresses the segregation of the types of individuals comprising that group. The measurement of intraclass correlation can similarly deepen our understanding of other kinds of sociological units.

Microfilm copy of complete manuscript of 141 pages, \$1.76. Enlargements 6" x 8", 10¢ per page.











**DISSERTATION ABSTRACTS**

**Volume XII, No. 5**

**1952**